JUN 16 1921

TELEPHONE ENGINEER

VOLUME XXIV JUNE, 1921 NUMBER 6

IN ALL EXCHANGES—UNDER ALL CONDITIONS STROWGER AUTOMATIC IS ADEQUATE

In exchanges of every size, under all conditions of operation, Strowger Automatic equipment renders service that is best suited to the requirements of the communities in which it is used. Designed primarily for no one particular type of exchange or service, it is easily adaptable to any.

The elimination of all local operating expense is only one factor in the economy of Strowger operation, but it is sufficient to justify its use, however large or small the exchange. For single or multi office systems, or for small unattended exchanges in rural communities, Strowger equipment is equally economical.

Prompt delivery of equipment for all types of service

AUTOMATIC ELECTRIC COMPANY

FACTORY AND GENERAL OFFICES, CHICAGO, ILL.

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Cleveland, 415 Cuyahoga Bldg. — Columbus, 516 Ferris Bldg. — Rochester, 519 Arlington Bldg. — Pittsburgh, 611 Lyceum Bldg.

ASSOCIATED COMPANIES:

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International Automatic Telephone Company, Ltd., London

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STANDARDIZATION

MONARCH APPARATUS complies with the true meaning of STANDARDIZATION.

Years ago when MONARCH equipment was first designed it was realized that in time certain parts would become worn and need replacing. With this thought in mind, all the individual piece parts of both TELEPHONE and SWITCHBOARD apparatus that have since been manufactured, improved or redesigned, have been so made that they will interchange with or replace properly any individual piece that may have become worn or broken, in all MONARCH TELEPHONE and SWITCHBOARD apparatus previously made.

All MONARCH equipment is so constructed that nearly all repairs and replaceals can be made with a screwdriver.

Mister Exchange Manager and Owner: Take a look at your Junk Pile and consider the amount of money you have tied up in telephone and switchboard parts that cannot be used because one little piece part is missing and cannot be obtained, and remember that MONARCH TELEPHONE and SWITCHBOARD parts are never obsolete because of their practical and substantial design, and that ALL PIECE PARTS ARE STANDARDIZED.

Real STANDARDIZATION for the Exchange means STANDARDIZING on MONARCH STANDARDIZED APPARATUS.

"Monarch for Service"

Monarch Telephone Manufacturing Co.

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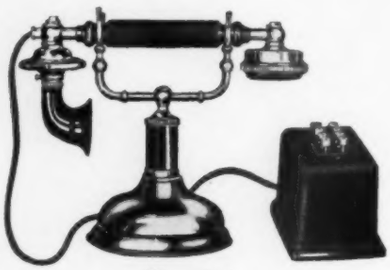
FACTORIES, INDUSTRIAL PLANTS, OFFICES, ETC., all over the country are using Interior Telephone Systems.

Are You Getting Your Share of Interior Telephone Profits?

Simplicity of installation and operation makes Federal Apparatus economical and popular



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A SYSTEM FOR EVERY SERVICE

Your Copy of Bulletin No. 610 Is Ready For You. Ask For It.

Federal Telephone & Telegraph Co.
Buffalo, New York

Here's a Dependable Ringing Supply

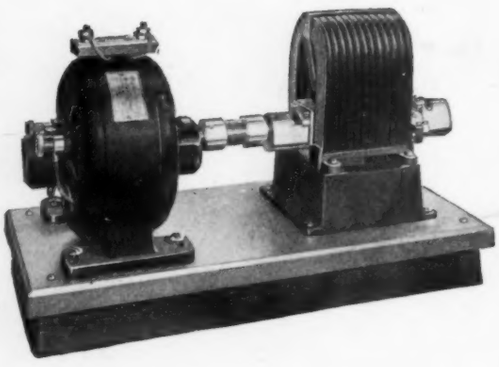
THE HOLTZER-CABOT MAGNETO RINGING MOTOR-GENERATOR

It generates its ringing current direct from the circuit, independent of deteriorating batteries and necessarily adjustable contacts.

It gives a 24-hour ringing current, continous and invariable.

Therefore it saves you in labor and up-keep expense.

It does more. It maintains the efficient, smooth-running of your exchange.



Your operators need never resort to hand generators to ring subscribers with a consequent reta dation of service.

It keeps your subscribers satisfied. With their telephone bells always operative, and the quick response of "Number, please," they have no reason to complain that "So and So could not get me on the phone yesterday," and "it takes forever to get the operator."

Prompt delivery can be made from stock

THE HOLTZER-CABOT ELECTRIC COMPANY

BOSTON CHICAGO DETROIT NEW YORK
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The Wire "League of Nations"

Cuban Telephone Publicist Outlines International Importance of U. S.-Cuba-Canada Telephone Link—Details of Submarine Cable Achievement

By Kenneth McKim
(Cuban Telephone Company)

While international relations is the big unsettled problem of the day, the telephone has contributed one valuable element in the establishment of a closer friendship between nations. The remark refers to the recently opened service connecting Cuba with the United States and Canada.

That this new method of communications will make for better and closer international relations finds support in the statements of Presidents Harding and Menocal, when they formally opened the service, and in the exchange of remarks by President Menocal and Premier Meighen of Canada two days later. The same sentiment was repeated over the telephone by Secretary Hughes and Dr. Desvernine, the Cuban secretary of state, and by a number of other cabinet ministers of both countries who took part in the memorable exercises.

Principally, in this case, perhaps, it means better international commercial relations, for nothing could have been desired to cement the friendship of Cuba and the United States. But other neighboring nations that do not enjoy that close communion in daily life which only the telephone can provide may find food for thought in this latest and strongest bond between the three great North American countries.

THE CUBAN CABLE.

Length of each cable, 115 miles.
Composed of three separate cables with one copper conductor in each.
One telephone conversation and several Morse messages may pass over each cable at the same time.
Except at terminating points, cables are laid several miles apart in order to insure greatest protection against accident.
Cables lie over a mile under water at deepest points.
Pressure at points of greatest depth approximately one ton to the square inch.
Several years of exhaustive development work were required.
Total weight, 3,500,000 pounds.
Weight of copper in cables, 400,000 pounds.
Total cost (approx.) $1,500,000.
The longest deep water submarine telephone cable now in existence.

Landing the Cable at Havana. Sir William Slingo, Consulting Engineer of the International T. & T. Corporation of New York, at the Extreme Left.

Havana is not only the first port of Cuba, but on the list of shipping centers in the New World she stands second only to New York. Most of her commerce is with New York, and the Stars and Stripes may be seen more frequently flying from a merchant vessel in Havana harbor than in any other foreign port in the world.

These facts present all the argument necessary in favor of a telephone connection between the two cities. Yet the service is not limited to Havana on the one end or New York on the other. For the lines of the Cuban Telephone Co. bring all the principal cities of that island into the international network, while it has been demonstrated that any locality included in the Bell system can talk with Cuba.

The extensiveness of the service was shown on the day that Presidents Menocal and Harding talked. While some 700 invited guests listened at the Pan-American Union building in Washington, and 500 others in the offices of the Cuban Telephone Co. in Havana held receivers to their ears, Colonel J. J. Carty called the roll of repeater stations from the Cuban capital to Los Angeles, Cal.

Construction Details.

By installing repeaters at Key West and Havana the cable service was established without loss of transmission efficiency. The Cuban Telephone Co. has placed repeaters through its long distance system from Havana to Sanitago de Cuba, a distance of 600 miles, so that the capital enjoys no special privilege in the matter of talking with the mainland.

There are three cables between Key West and Havana, the longest of which is 105 miles, a long distance mark. That provides not only three talking circuits but a total of six telegraphic circuits, three a.c. and three d.c., which are being occupied by private leases for handling brokerage, press and other traffic.

The cables were laid and are operated by the Cuban-American Telephone & Telegraph Co., which is jointly controlled by the International Telephone & Telegraph Corp. and the American Telephone & Telegraph Co. The Cuban Telephone Co.'s system is brought into the service through the International

Telephone & Telegraph Corp., with which the former is associated.

Hernand Behn, president of the Cuban Telephone Co. and the Porto Rico Tele-

In the Cuban Telephone Company's Automatic Plant.

phone Co., is also president of the Cuban-American Telephone & Telegraph Co., and the other officers of the cable company are drawn equally from the International and American companies.

Each cable has a single copper wire, and a thin copper tape is wound spirally outside the insulation to obstruct the inquisitive boring of the toredo, a diminutive but destructive insect of the sea that as likely as not would try to tap the wire and deadhead a message. The toredo does not include copper in the wide variety of articles that appear on his bill of fare, however.

The conductor of each cable is loaded with a continuous spiral wrapping of very pure iron wire, whipped around the conductor, in contact with it, and so closely as completely to cover it.

Outside the insulation is wrapped, in contact with the protecting tape previously described, two copper tapes so wound that they do not quite touch at the edges. These serve to retain as far as possible the natural flexibility of the completed cable. Their resistance is approximately half that of the conductor core, and they furnish a return-current path of high conductivity, besides serving to overcome in great measure the increase in effective resistance which takes place in a single core cable when alternating currents are sent through it.

In experiments made with such a cable in the British channel it was shown that at a periodicity of 800 the resistance of 11 ohms per mile to a direct current was increased by 2.4 ohms with the alternating current, so that the effective resistance showed an increase amounting to 22 percent, with a consequent increase of 10 percent in the attenuation constant.

Take another case, that of the St. Margarets-Dunkirk cable. The conductor was much heavier, and the ohmic resistance to direct currents was 2.8

The Havana Terminal.

ohms per mile. The effective resistance to an alternating current at 800 periods per second was 5-47 ohms, or an increase of 96 percent in the direct current resistance.

The fact that the net increase in resistance did not vary much with conductors of widely different gauges suggests, according to engineers, that the extra resistance is that of the earth-return. Experiments conducted with the new cables showed a very much smaller increase, attributable to the employment of the copper tapes.

Galvanized iron wires provide a sheathing against the chemical action of salt water. In the shallow waters near the shore the sheathing is, of course, heaviest.

Over the sheathing wires is an outer protective covering consisting of two servings of tarred jute yarn wound spirally and in opposite directions, with compound coatings under, between and over the yarn servings.

The twin cables for giving the earth connection are 3.2 nautical miles long on the Key West side and 1.5 to 2 miles on the Havana end, where the deep water is much closer to the shore.

Most previous submarine telephone cables have been built on the coil-loading principle, because of the expense involved in constructing a continuously loaded cable equal in efficiency to the other type. But other telephone cables have lain in comparatively shallow water, say, 100 fathoms or less, while the maximum depth between Key West and Havana is more than 1,000 fathoms. The deep water encountered in this case, however, the obvious difficulties in the way of making repairs satisfactorily on a coil-loaded cable, and the good records for uninterrupted service established by the few existing continuous-load cables were factors considered in reaching a decision to adopt the continuous load for the Havana-Key West connection.

The success of the new communications has demonstrated several interesting and purely technical facts; but it has proved also that Cuba is to be reckoned among the most progressive nations and one wide awake to the necessity for keeping abreast of the times in the expansion of her commercial life. And Cuba, it may be seen, has a full appreciation of the importance of the telephone in the conduct of a growing and going industry, whether it be a private concern or a nation.

Appleton Wis., Hopes for the State's Prize.

Appleton, Wis.—Contracts have been let for the construction of a new exchange here for the Wisconsin Telephone Company, which will be one of the finest in the state, according to local reports.

Paying Cable from Barge at Havana.

Veteran Shooter on "Trouble"

From Pencil Marks to Salty Air Nature Engages in Battle of Wits With the Troubleman—He Comes Up Smiling—Some Puzzling Experience

By J.P.Whitson

Every person who has been in the telephone game for any length of time has had some very unusual cases of trouble, and in my sixteen years of service I have run up against many cases that seemed at the time to be very hard, afterward finding some of them were very simple.

The first case I recall happened in 1905. I was combination manager and lineman for the Southwestern Telegraph & Telephone Co., of a little magneto exchange in Texas. We had about 150 subscribers. I had just been promoted from night operator, and my chief experience and qualifications for the job was a copy of "Hyde's Telephone Troubles and How to Find Them." And let me remark right here that to anyone who never had any experience at all this was about the best little book I ever saw.

Unique "Line" Trouble.

We never had any lead covered cable at first, but just a bunch of jumper wire running from office pole to the switchboard. These terminated in a box we made ourselves, where they connected with the line wire jumpers by means of wood screws and copper washers. We kept having trouble with some of the lines showing a partial cross. We could not locate it, for when we would disconnect both ends of jumper wires it would show clear each way. This had me puzzled for some time. But after while I noticed that where the screws entered the wood of the box there was a heavy pencil mark so that the screws would be in a straight line. And on the lines in trouble it was heavier than other places and the screws were exactly in the center of the mark. I erased this and my trouble was gone.

Another time on this same exchange we had a four party grounded line that could not ring central, neither could central raise the subscribers. We tested the line out by taking every drop wire loose, and the line showed clear. We put them back one at a time and it was O.K. until we got to one nearest to the exchange, and that one would put the trouble back on. The line showed clear through the arrester and on up to the telephone, and when we would take it loose it would ring its own bells all right. I happened to notice once, when some other subscriber was ringing on the line, that the crank on the telephone in trouble would turn slightly. This solved my trouble—the lightning had burned through the insulation of the contact springs and the generator would not shunt off the line. This was giving me a ground through the generator, which was almost a dead ground.

Still another case on this same plant was after we had put in two lead covered cables. One served the north part of town and the other the south. In just a little while after they were installed, every time it would rain every telephone on the south side would be crossed. When it stopped raining it would be clear again. I talked to the superintendent about it and he said it was in the cable. So they sent a cableman out of Dallas. He tested it thoroughly and could not find any fault, and reported it O.K., but every time it would rain after that they would cross again. So one day during a long, heavy rain I went out to the cable hole and opened the lines. They showed clear through cable, but crossed behind he. I then cut the jumpers loose on lines and lines showed clear. It was the jumper wire not being waterproof as it was supposed to be, and while it was raining would cause a water cross.

Now Some Ground Grief.

A few years later I was troubleman on a common battery exchange and we had some rural lines that were common battery, but had local batteries cut in at each telephone to boost the transmission. One line about five miles long was showing fourteen volts ground, which made the signal permanent. The line tested clear up to the last subscriber. He was three poles off of main lead. It was dry, hot summertime and his poles were native white oak, peeled, and hard as rock. The trouble showed between the house and our last pole. I walked over several times and could not see anything that would cause that heavy ground. There was one place where the bracket had pulled off and line was tied around the pole. Finally, in desperation I got up there and took this loose. This cleared the trouble. The pole had a soft heart and would hold the moisture for a long time. The sun had cracked the hard shell right where the wire was tied around the pole; the ants were working in and out, and this made enough moisture to cause the ground. Another similar case on this same exchange was caused by a rusty coating forming on a porcelain knob nailed to a green tree.

An another time on this same exchange we had a ground showing on one of these rural lines and chased to end of line through the arrester, subscriber's set, and to wires running to the batteries. I examined the wires, looking for staples or tacks that had cut through the insulation, etc., but could not find anything. After several tests I finally picked up the batteries to examine them and found the bottom had come off the paper shell and it had been sitting on a nail. This nail went through the floor and into a soggy foundation log which was resting on the damp ground. This held moisture, and the batteries, being always connected one side to line, gave us a ground on this side.

Still another case was a line noise on a pumping station on the pipe line. It was the same class of line as the above case and on the same exchange. At times the line would be so noisy you could not use it, and at other times of the day it would be perfectly quiet. It never showed anything on the voltmeter and did not act like a loose connection. I tested it on through the telephone, then took battery wires loose from telephone and it was quiet. Put them back and it was noisy. I couldn't see a thing wrong, but the batteries were setting in a storage battery cabinet and the machine was running, charging them. The machine shut down while I was there, and the telephone was quiet again. So I took the batteries out of the cabinet and put them inside of the office, so we did not have any further trouble with the noise. I never did know just what caused this, unless it was they were picking up induction from the charging current.

Magneto Cut-outs Puzzle.

One time when I was manager of a magneto exchange we had a grocery store and the owner complained his tele-

phone cut out. The operator said it would, at times, but I could never catch it and could not make much of a test. But I started in charging the receiver cord, and every time it would be reported would change the telephone, rewire the house, change the drop wire, get a new pair in the cable, and finally I changed the drop and jack number on the switchboard, and never did find anything. But he quit complaining, so I suppose it must have been cleared. A cut-out on a magneto telephone is a mean case of trouble, for there are so many things that can cause it.

The worst kind of trouble I can think of now is bad sleeves on copper toll lines. Down in southeastern Texas near the coast, where we have that damp, salty air to contend with, we had lots of sleeves to go bad. And sometimes the only way we ever found them was with a galvanometer. We would have the line shorted at every pole until we struck a span that measured too high resistance. We would then cut out the sleeves. Of course, where the sleeve caused a noisy line we could locate by listening on line with receiver and having a short put on line at different places. The short would kill the noise if it was between the noise and the one listening. This is about the only method we use in locating grounds on telephone lines for the long pipe lines. The most of them have only one circuit, with stations every few miles. At present I have in my charge one line that is 200 miles long with twenty stations on it.

Washington's Calls Beat War-time Record.

Washington, D. C.—According to officials of the Chesapeake & Potomac Telephone Co. the daily average business in the Main exchange is exceeding that of the war period, when thousands more people were in the capital.

Wireless Phone System Planned for Chicago.

Chicago, Ill.—N. Banks Cregier, son of a former mayor, has applied for a 20-year franchise to install and operate a wireless telephone system in Chicafo.

Rate Zoning Contemplated for New York Territory.

New York City.—Certain calls within the city of New York are to be charged at toll rates, while some points outside the city lines will be included in the local zone, if plans attributed to the New York Telephone Co. are carried through. J. S. McCulloh, vice president of the company, in outlining the proposed change to a reporter, said: "The present system of zoning on the political lines of a city is unfair to subscribers."

SOUTHWEST HUMMING.

Great Construction Program of Southwestern Bell Shows Progress.

St. Louis, Mo.—Business generally may not be "up on its toes," but the observer who confined his inspection to the Southwestern Bell would never get an idea that the country at large was in the throes of any business depression.

Here are some of the things the Southwestern is doing, according to the company's News:

At El Dorado, Ark., work has been begun on rebuilding the entire outside plant at a cost of about $46,000. On aerial construction 24-gauge cable will be used. The rebuilding of the plant at El Dorado is due largely to the oil boom.

Material has arrived at Helena, Ark., for providing additional switchboard facilities to the value of $17,000.

An outside plant job to afford relief from the congestion at Fort Smith, Ark., has just been completed at a cost of $42,000.

Two carloads of material have reached St. Joseph, Mo., and work will soon be begun on the installation of machine switching there. An addition to the Jefferson building has been completed to house the new machine switching equipment, which will add 3,000 lines to take care of the city's growth.

Four floors added to the general office headquarters in St. Louis have been completed and are occupied.

The Western Electric Co., with about 150 men at work, is pushing the installation of machine switching at Kansas City.

Material has arrived for additional switchboard facilities at Colfax, St. Louis. This work, which will be completed this summer, will provide 1,200 more lines and will cost about $75,000. Similar work at Forest to provide more trunks has just been completed at a cost of $40,000.

Additional switchboard material has arrived at Lindell, St. Louis, to add more trunks to other offices. The estimated cost is $25,000. Work is progressing on switchboard installation at Olive to provide for 1,400 more lines and trunks at a cost of $200,000. Material is on the ground to add more trunk switchboards at Sidney, St. Louis, at a cost of $30,000.

Addition to the switchboards at Arkansas City, Kan., will be completed soon at a cost of $12,000, adding 300 lines to the city's facilities.

At Chanute, Kan., work is progressing on the installation of a new toll board which is partly in service now. The work will cost about $35,000.

The Garden City, Kan., entire plant is to be rebuilt by June at a total cost of $59,000.

Work has been begun on the installation of a new toll board in Iola, Kan., and will be completed in May at a cost of $45,000.

At Newton, Kan., work is being done one additions to the switchboard which will add 300 lines, the cost being $15,000.

The installation of a new common battery switchboard at Stafford, Kan., is just being completed. This job, which provides for 500 lines, has cost $39,000.

At Wichita, Kan., work has been completed on additional switchboard which will add 1,500 lines at a cost of $90,000.

At Pittsburg, Kan., a consolidated plant job is just being finished which required the expenditure of $100,000 on outside plant work.

Kansas is doing a lot of good roads work now, which means that the Bell is put to considerable expense. As the course of the roads is changed, toll lines must be reset.

In Oklahoma City, Okla., the largest Southwestern toll line job now under way is being carried on from Sapulpa to Holdenville. The entire line of 84 miles is being rebuilt at a cost of $130,000.

The Southwestern company recently completed the purchase of the pole line from the Midland Valley Railway Co. which runs from Silverdale, Kan., through Tulsa and Muskogee to Arkansas. For a number of years the company has leased wire space on these poles.

The $300,000 outside plant relief work at Muskogee is about half done and will be completed this summer.

Machine switching equipment has arrived in Oklahoma City and work on the installation wil lstart in a few weeks. This equipment will be placed in the northwest office, for which a building was erected at a cost of $92,000. The switchboard will cost $450,000, and the outside plant, to take care of the 3,000 lines to be immediately installed, $150,000. The building is arranged to accommodate 15,000 lines ultimately.

In Texas, Dallas some time in July will experience not only the biggest cut ever made in the Southwestern system but probably one of the biggest cuts made in the United States. The whole downtown section will be cut over from manual to automatic. Work is progressing rapidly toward this cutover. At Fort Worth downtown Lamar office work is progressing on additional toll switchboard to cost $50,000, and on local switchboard to cost $120,000; at the Prospect office, $60,000, and at the Rosedale office, $75,000.

Telephone Price Conditions

Stromberg-Carlson Sales Manager Writes Survey of Price Situation Applying to Telephone Equipment—Presented before Iowa Phone Meeting

By George A. Scoville

In considering what the trend of prices is going to be in the future, it is necessary that we first become familiar with what the present price levels are.

Most of the declines that have already taken place were on articles that doubled and trebled in price during the war period. Silk and cotton yarns, for example, rose to levels about 300 to 500 percent higher than pre-war levels. Copper rose to levels about 200 percent above pre-war prices; antimony rose 300 percent, tin 320 percent, aluminum 100 percent, zinc 250 percent, iron and steel about 150 percent, etc.

Some of these commodities have dropped a little and some have dropped so much that they are bound to recover with increased buying. Most of them, however, have dropped to levels that are about 75 percent above pre-war prices. In the case of the United States Steel Corp., which recently reduced its prices, the new price levels are still about 70 percent above pre-war prices.

A house with lot, costing $10,000 to $11,000, could be built in Rochester, N. Y., in 1914 for approximately $5.25 per square foot. An approximate figure for the same house on July 1, 1919, was $7.32 per square foot; on February 1, 1920, $10.37; July 1, 1920, $11.96; April 8, 1921, $9.65; today, $9.25 (figuring 15 percent reduction in labor cost). This $9.25 is still 76 percent above 1914 prices. This figure of 76 percent tallies in an interesting way with the cost of a standard concrete factory structure as figured by the Aberthaw Construction Co. Such a factory costing in December, 1914, 100, would have cost 266 in June, 1920, and 176 on May 1, 1921, or 76 percent above 1914.

Confidence in Quarter Cut.

Reductions to about 70 to 75 percent above pre-war levels seem to have reestablished confidence, and buying seems to have resumed in commodities that have reduced that much. I understand that the farmers of the middle west, whenever they need anything, are studying their catalogs, and when they find an article that is priced about 75 percent above pre-war levels they go ahead and buy, but if it is still priced higher than that they are holding off buying, hoping for a further decline.

In the case of our products the principal increase was in construction material, which rose to prices about 100 to 150 percent above pre-war levels. There already have been numerous declines in the prices of construction material, and the present-day levels are about 75 percent higher than our pre-war prices.

The next largest increase in our line was on switchboard cable, which rose to prices about 100 percent above pre-war levels. Cable prices have been substantially reduced, due principally to reductions in the cost of silk and cotton, and are now about 60 percent above pre-war levels.

As to the remainder of our line, consisting of switchboards and telephones, the advance in price was a very reasonable one.

The total advance was about 68 percent above pre-war levels; in fact, they only reached the level that those materials that declined have now come back to.

There were several reasons for switchboard and telephones not going higher than this. In the first place, there was practically no demand whatever for either switchboards or telephones during the entire period of government control, viz., from July 1, 1917, to July 31, 1919, and there was keen competition for such orders as were being placed.

Improvements Hold Increases.

During the last three or four years we have made improvement after improvement. As we were favored with volume we changed manufacturing methods, rearranged work, changed machinery, etc., and this factor together with the benefit obtained by increased volume is responsible for our prices not increasing anywheres near the proportion that most commodities did during the last three or four years.

Then, too, there has been a close tie binding telephone manufacturers to operating companies, such as the tie between the Western Electric Co. and the Bell properties; the tie between the Automatic Electric Co. and the Gary properties; the tie between the Stromberg Co. and the Rochester properties, which we have many stockholders in common—which have tended to hold down manufacturing profits and limit them to a minimum.

The largest amount of profit which the Stromberg Co. has made during any one of the past five years was in 1919, when we earned 9.6 percent net on our sales, and this decreased during 1920 to 9.1 percent. Without the enlarged volume of business we enjoyed during both these years it would not have been possible for us to have made even that much.

In an ordinary business, selling prices would have gone much higher than they did in the telephone manufacturing field.

Humpty Dumpty Careers.

The point I am trying to bring out is that articles which rose to a high point naturally have had a spectacular fall, but that most of the spectacular drops have already occurred and from now on the reduction to our new future level is bound to be more gradual. I personally do not believe that we will ever get back to pre-war levels. The spirit of the time seems to be to want to provide a better scale of living for every individual in this country. Where wage increases have been excessive we want to see reductions made that are justified by the decrease in the cost of living, but we want everyone to live as least as well as they were living before the war, and the cost of living on the average continues to be about 68 percent above pre-war levels.

Labor constitutes, directly or indirectly, 90 percent or more of our costs (coal, for example, is mostly labor plus transportation, and transportation also is mostly labor), and future declines are going to be governed more by future wage levels than by any other factor. In the recent St. Paul rate case, manufacturers testified that from 60 to 70 percent of the resale price for telephone equipment was labor. Again, of our purchased material a large proportion is labor, so that 90 percent is a fair estimate.

Labor Costs Big Item.

In September, 1920, a series of detailed estimates were made on one class of our equipment, basing them on the then existing market material costs and

actual labor costs. Thirty days ago the same studies were brought up to date as to present market material costs and present labor costs, and there was an average cost of 15 percent. This is interesting because the raw material market had nearly reached the top during the summer of 1920 and shows the part that labor increases have placed since that time.

Our telephone prices have remained practically constant during the last year, and, following our costs, prices should have increased to take care of these cost increases during that period.

Our costs will increase for a while longer, because when we purchase raw materials at a price they cannot be delivered, manufactured into piece parts, assembled into sub-assemblies and finally produced in finished apparatus for a period of from four to eighteen months after the material is purchased; therefore selling prices must lag from four to eighteen months behind costs. While this factor will retard the dropping of telephone prices, at the same time it also was responsible for telephone prices not starting to increase for a period of twelve to eighteen months later.

We are doing everything we can to bring down our costs through greater efficiency and greater productiveness, and intend to give our customers the benefit of these savings as rapidly as they can be made. The reductions cannot start at once without substantial losses being taken, and are going to be gradual, and I doubt if they will drop more than 10 to 15 percent below our present level for a period of five years, unless all the present-day expectations are upset and the whole country gets back to a scale of wages much lower than now seems possible or probable.

WATERLOO'S TOLL TIPS.

R. J. Hopley, Commercial Manager at Waterloo, Ia., Advises on Co-Operation.

Waterloo, Iowa.—What Waterloo is doing to build toll business is told by its active commercial manager in a recent issue of the Northwestern Bell. The commercial chief, R. J. Hopley, says:

A few days ago the business manager of a local newspaper dropped into my office and handed me the following insert:

The cash register sings
When the phone bell rings.
Our message this month is:
Phone business pays.
Educate your people to use the telephone.
It overcomes procrastination.
It brings in extra business.
It creates new business.
It makes the bank book smile
With a smile worth while.

It is evident from the above that the business men of the various business organizations, factories and industries are doing their utmost to create out-of-the-city trade over the telephone. In reading this insert the question came to my mind, "What are we doing to assist the business firms of our communities in this respect, and what are we doing to build up our toll business?"

On receipt of the above, a review of the Waterloo office was taken on "Building Up Our Toll Business," which summarized itself into the following:

1. Assisting the business man to place his calls under the classification which is applicable to his business.

2. Conducting people of various business organizations through our central office, and, while visiting the school room, taking a few minutes with the blackboard and chalk to explain in detail classified toll.

3. Department and interdepartment discussions on this question.

4. Lectures to high school, business college and college students, explaining in detail the various classifications and pointing out to them their responsibilities in being familiar with these items when they enter the business world.

5. Campaigning among our toll agents and connecting companies.

Under No. 1 I have in mind a certain wholesale coal dealer in the city whose toll averaged $500 a month, and who was on the verge of discontinuing long distance orders and conducting his business exclusively by correspondence. In an interview with the subscriber it was discovered that he was placing all of his calls under the person-to-person classification. It was then pointed out to him that he could handle successfully his business over long distance, under the station-to-station classification. The subscriber's account still averages $500 a month and he is doing a greater volume of business.

MODEL PLANT SCHOOL.

List of Papers Read at School for District Plant Chiefs by Southern Bell Experts.

Atlanta, Ga.—Probably one of the most successful district plant chief schools ever held was that conducted by the Southern Group of Bell Telephone Companies in this city recently.

The subjects covered included practically every phase of plant management, and the course represented a compact education in approved telephone practice. Sessions were held daily except Sunday, from 8:45 to 12:20 and from 1:40 to 5. As the program was prepared after an exhaustive survey of the plant chiefs' needs, it is reproduced in full, with time allotments, for the benefit of others planning such schools.

The subjects and time (in hours) allowed for presentation of papers and discussion:

Cable Maintenance—2½; Cable Testing Routine—½; Sub-station Installation Practice—1½; Fundamentals of Toll Transmission—2; Principles and Use of the Telephone Repeater—1¼; Toll Maintenance Practice—2¾; Exchange Transmission Testing—¾; Inductive Interference—1¾; Service Order Assignment Routine—2; Ordering and Handling Supplies—1; Central Office Maintenance Routine—1½; Systematic Maintenance Routine—1¼; Maintenance of Records of Property—2¼; Inspection of Assignment Records at Ivy Office—1; Visit to Western Electric Shop and Warehouse at 230 Lee St.—2½; Some Telephone Transmission Problems—1; Classification of Plant Personnel—1¼; Selection and Placement of Personnel—1¼; Handling of Exchange trouble (introductory notes on paper)—1¾; General Station Maintenance—2; Examination of the District Plant Chiefs by the Army Intelligence Test—½; Some Problems of Management—1¾; The Company's Educational Plans—3½; Consideration of Electrolysis—½; Joint Use of Poles—¼; Inspection Interior Block Construction; Traffic and Plant Relations—1; Insurance Coverage Practice—¾; Plant Accounting Practices (material accounting, classifications and sales accounting)—1¼; The Legal Viewpoint on Contracts and Accident Reports—¾; Engineering to Meet Future plant needs, (a) constructions according to carefully laid out plans, (b) completion of work according to specifications, (c) careful maintenance of the cable plant and the insulation of the general plant)—1; Disbursement Accounting Practice—1; Building Maintenance—½; Central Office Engineering Practice—1½; The Plant Chief's Relation to the Western Electric Co.'s Installers—¾; Machine Switching Telephone Systems—½; Demonstration of Automatic Equipment—½; Some Principles of Human Relations—2; How Commercial and Plant Can Work Together—½.

THE TELEPHONE FAMILY CIRCLE

Texas Telephone Men Are Versatile Leaders.

Chicago, Ill.—John Stratton, Texas sales manager for Kellogg Switchboard & Supply Company, and his fellow workers in the Lone Star State, R. S. Martin and C. G. Gardner, have compiled a list of prominent Texas telephone men who also are active in other lines. The list, which appears in the Kellogg house organ, names:

H. J. Patrick, of the Clarendon Telephone Company; also president of the Clarendon National Bank.

T. R. Homesley, of the Comanche Telephone Company; also vice president of the Comanche National Bank, also owns a 40-section ranch in Arizona.

W. P. Morton, president of the Haskell Telephone Company; also president of the Haskell National bank, also stockman.

A. L. Robb is president of the Electra Telephone Company; also Electra banker and oil operator.

C. N. Munn, of Goodnight, owner of the Goodnight Telephone; also a ranchman.

Sidney Webb is president of the Crosleyton properties; also a ranchman, an oil operator, and has mining interests.

H. C. Bordwell is president and general manager of the Double G. Company Post Telephone Exchange; also operates the most modern cotton mills in the west.

J. J. Murphy is vice president of the Gonzales Telephone Company; also a bond broker, capitalist and agriculturist.

C. Stribling, of Central Texas Telephone Company; also a Llano banker and stockman.

S. A. Lindsay is president of the Gulf States Telephone Company of Tyler, Tex.; president also of the National Bank of Commerce.

R. B. Still is general manager of the Gulf States Telephone Company, Tyler, Tex.; also vice president and chairman of the board of directors of a laundry company; also mayor of Tyler.

E. J. Mantooth is president of the Lufkin Telephone Company of Lufkin; also president of the Power & Light Company; also president of the Lufkin National Bank.

Lewelyn Rust is president of the Del Rio & Western Telephone Company of Del Rio; also president of the Del Rio National Bank; also owns a large ranch.

John Y. Rust is president of the San Angelo Telephone Company of San Angelo, Tex.; also a ranchman.

C. G. Robson, of LaGrange, Tex., is president of the Southern Telephone Company; also owns a large goat and mule ranch in west Texas.

Hayden Heat is president of the North Texas Associated Telephone Company; also vice president of the M. & P. Bank.

C. A. Shock is secretary, treasurer and general manager of the North Texas Associated Telephone Company; also is manager of the modern modern Holstein and Jersey dairy in the southwest.

NEW U. S. I. DIRECTORS.

Pogue of Louisville and Harris of Kansas City Additions to Independent Staff.

The gap left in the directorate of the U. S. Independent Telephone Association by the resignation of S. M. Heller, has been filled by election as a director of the association of P. S. Pogue, president of the Louisville Home Telephone Company and the Central Home T. & T. Co., and vice-president of the Independent Long Distance T. & T. Co.

Mr. Pogue has been connected with the Louisville Home Telephone Company since its start, serving during the construction of the plant, and as purchasing agent, general superintendent and general manager before his election to the company's presidency. He is prominent in Kentucky public utility circles.

H. L. Harris, the prominent Kansas City telephone executive, has been elected to fill the vacancy on the board of directors of the U. S. Independent Telephone Association caused by the death of E. B. Fisher of Grand Rapids. The office of chairman of the association's board, held by Mr. Fisher, has been abolished.

Mr. Harris is vice president of the Kansas City Home Telephone Company, Kansas City Long Distance Telephone Company and of Theodore Gary & Co. His telephone experience includes many active years in the operating and manufacturing branches of the industry. As an engineer and salesman he was connected with the Dean Electric Company, its successor, the Garford Company, and the Stromberg-Carlson Telephone Manufacturing Company. From Stromberg-Carlson he went to Kansas City three years ago as general manager of the Home organization.

'Ray for Mike Hegarty — Forty-two Years of Climbing.

Omaha, Neb.—Mike Hegarty celebrated his forty-second year of active telephone service in May. Mike is still as spry as a squirrel on the poles. In addition to the personal service of the head of the Hegarty family, the telephone industry is enriched by the work of its three sons—Dan, division toll inspector at Omaha; Mike, Jr., wire chief at Decatur, Neb., and Frank, Omaha lineman—and a charming daughter who was a P. B. X. operator at Omaha's City Hall. Mike's photograph and his history appear in a full-page article in the Northwestern Bell family sheet.

Frank E. Rendall, of Duluth, has been appointed general counsel for the Northwestern Bell Company. Other appointments announced by the company include Zenus E. Hook, commercial manager at Audubon, Ia.; A. W. Deveraux, construction superintendent for the Iowa division, and C. A. Phillips, district plant chief at Grand Island, Neb.

Ivan Bowen, of Mankato, Minn., has been named to fill the vacancy on the Minnesota railroad and warehouse commission created by the death of Judge Ira B. Mills. Mr. Bowen is an attorney and a world war veteran.

The Lincoln, Neb., T. & T. Company has promoted several of its employes who have been in the service of the company from five to fifteen years. The promotions include H. W. Wheeler to superintendent of construction of the system, K. B. Cary to district plant chief of western division, T. O. Rinehart to plant and commercial manager at York, H. F. McCulla to local commercial manager at Hastings, Ed Cummings to switchboard installer for the system, W. A. Coffendafer to district inspector at Hastings, and R. H. Ojers to general foreman.

William J. McLaughlin has been appointed to succeed Harold W. Worthley as commercial superintendent of the New Hampshire division of the New England T. & T. Company. Mr. Worthley has been assigned to the staff of the New England general commercial superintendent to handle the commercial and public relations problems of machine switching.

Western Electric Shifts Executive Personnel of Houses.

New York.—The Western Electric Co. announces several changes in its organization. Frederick H. Leggett, formerly eastern district manager, has been appointed general manager of telephone distribution in charge of telephone distributing houses, reporting to F. B. Gleason.

Other changes follow:

J. B. Odell has been appointed manager of the telephone distribution house at New York.

E. A. Brehm has been appointed manager of the telephone distributing house at Philadelphia.

L. A. Davies has been appointed manager of the telephone distributing house at Dallas, reporting to H. N. Goodell.

Most of the men affected by the Western Electric changes are veterans in its service. Fred Leggett will celebrate his twenty-third anniversary with the company next month. He started in its New York house after his graduation from Dartmouth in 1898 and stayed there for four years. 1902 found him, first in Chicago, and later in Japan where he acted as secretary of the Nippon Electric Company. Mr. Leggett was appointed manager at Antwerp in 1906, foreign sales manager at New York in 1909, Pacific district manager in 1912, New York district manager in 1917, and eastern district manager three years ago.

D. C. Cox, for the past ten years division general manager of the New York Telephone Company, with headquarters at Syracuse, has been made active field vice-president of the Friendship Telephone Company. Newspapers in the Friendship company's territory comment in a congratulatory strain on the appointment.

C. B. Crawford has been made commercial manager of the Tri-State at Winona, Minn. Crawford is one of the most popular men in his section of the industry. As an indication of his standing, when he was transferred from Faribault, business men of the city presented a protest against his transfer, being unaware that he requested the change in order to broaden his training.

George Cameron, construction superintendent of the New England T. & T. Co., recently celebrated his thirty-eighth anniversary in the telephone business. Congratulations from all over the system poured in on the popular veteran.

DR. ROSA DIES.

Famous Scientist Suddenly Expires at U. S. Bureau Office—His Active Career.

Washington, D. C.—Dr. Edward Bennett Rosa, chief physicist of the U. S. Bureau of Standards, died suddenly in his office at the Bureau May 17. Dr. Rosa was born in Rogersville, N. Y., Oct. 4, 1861.

Dr. Rosa was a graduate of Wesleyan University, Middletown, Conn., in the class of 1886. After leaving Wesleyan he entered Johns Hopkins University as a graduate student and received the degree of Doctor of Philosophy in 1891. In 1906 the honorary degree of Doctor of Science was conferred on him by Wesleyan University.

For a short time he was instructor at the University of Wisconsin, leaving there to become professor of physics at Wesleyan University. He became the chief physicist at the Bureau of Standards in 1901.

He did notable work in science and electrical engineering. He took a leading part in the researches to establish the fundamental electrical units after coming to the Bureau of Standards and served as secretary of the International Committee on Electrical Units and Standards. He developed the electrical work of the Bureau of Standards from small beginnings into an organization covering the scientific and engineering aspects of a great national laboratory.

When Dr. Rosa took charge of the Electrical Division of the Bureau of Standards, in addition to the general supervision of the work of the division, he took active charge of the section on inductance and capacity and absolute measurements. As the work of the electrical division grew it was necessary for him to relinquish some of the detailed work of this section. However, he remained in active charge of the section until the division moved into the electrical building in 1915.

When Dr. Rosa began his work in the electrical division it was his ambition to determine a number of the fundamental electrical constants. In conjunction with Dr. Dorsey he immediately undertook the determination of the ratio of the electromagnetic and electrostatic units. The results obtained are the most accurate which have ever been determined.

About 1907 Dr. Rosa and Dr. Dorsey started their work on the determination of the ampere. This work ran over a period of years and gave a value of the ampere which had not previously been equaled. In order to be able to reproduce the ampere in a concrete way Dr. Rosa and Mr. Vinal started work on the silver voltammeter. This was carried on simultaneously with the absolute determination of the ampere so that now we are able to define the ampere in a satisfactory manner.

Dr. Rosa devised a new apparatus for determining the absolute value of the ohm. In connection with Dr. Grover, he collected together practically all the known formulae for computing inductance.

In 1910, there was instituted under Dr. Rosa's direction an exhaustive investigation into the subject of electrolytic corrosion of underground gas and water pipes, and lead cable sheaths due to stray currents from electric railways. This problem has for years been one of major importance to public utility companies throughout the country, and prior to the work being taken up under Dr. Rosa's direction at the Bureau of Standards very little definite information was available as to the laws governing electrolytic corrosion or the methods of reducing trouble from this source. The work done under his direction included a definite establishment of laws governing electrolytic corrosion, and much progress in the direction of mitigating trouble of this nature. This work has for a number of years been carried on in close co-operation with the utility interests of the country through the medium of the American Committee on Electrolysis, of which Dr. Rosa was a member.

During the war, Dr. Rosa directed the development of a number of scientific instruments which were of inestimable value to the American forces in France.

Cumberland Valley Headed by Wm. J. Lescure.

Harrisburg, Pa.—At the annual meeting of the stockholders of the Cumberland Valley Telephone Company of Pennsylvania, the following officers were elected: William J. Lescure, president; John C. Motter, vice-president; O. K. Kines, secretary and treasurer, and Cameron L. Baer, general manager. The following board of directors was named: William J. Lescure, John C. Motter, W. Grant Rauch, C. L. Long, Frank A. Zimmerman, W. E. Weller, James K. Trimble, S. W. Foulkes and A. E. Pendergast.

Ulffers New Bell Manager for Kansas.

Topeka, Kan.—Carl A. Ulffers has been appointed general manager of the Bell Telephone Company properties in the state of Kansas.

Eliminating the Side Tone

Design of Subscribers' Station Equipment — The Problems Met and Vanquished in Retaining Strong Transmission Qualities and Eliminating Side Tone

By W. N. Furthman

In the manufacture of subscriber's telephone station it has for a long time been well known that a station can be designed which would be more sensitive than the present standard substation, and which would, therefore, transmit telephone voice currents over a greater distance. While a substation of this kind would be highly desirable from an

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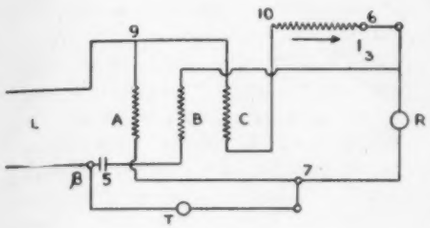

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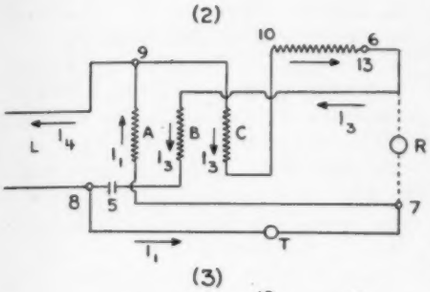

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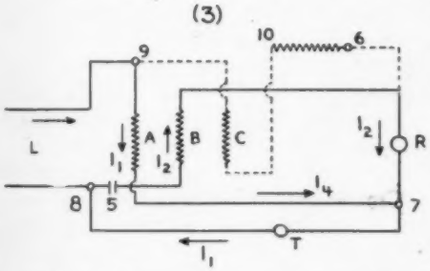

engineering standpoint, as well as from a commercial one, it has been generally found that in order to obtain such a substation it would be necessary to find a means of overcoming the excessive amount of side tone which would be present in a set of this kind, due entirely to its increased degree of effectiveness.

The Engineering Problem.

In a station of this kind it is necessary, of course, that it shall deliver, first, a maximum amount of energy to the receiving apparatus of the communicating station; second, that the receiving apparatus shall be protected from interference by transmission energy originating at same station.

This desirable result has been obtained by providing substations consisting of a transmitter, receiver, an auxiliary resistance and a transformer having a plurality of windings which, in combination with an ordinary telephone line, would satisfy the following fundamental requirements: Given two substations designed for two-way communication and connected by a line of given impedance and length, the amount of energy absorbed by the receiver at the receiving station shall be the maximum part of the total telephonic energy developed by the transmitter at the transmitting station.

In order to accomplish such a result the following requirements must be fulfilled: First, the transmitter and receiver shall be conjugated, that is, there shall be a negligible amount of side tone in the receiver in consequence of the actuation of the transmitter by the sound waves; second, the line and auxiliary resistance shall be conjugated in order that none of the energy absorbed by the substation from the line shall be wasted in the auxiliary resistance; third, for a given line having a definite impedance the telephonic energy delivered by the transmitter shall be a maximum; fourth, the amount of energy delivered by the line to the substation shall be the maximum, that is to say, the impedance of the substation as seen from the line shall be equal to the impedance of the line; fifth, at a small sacrifice of efficiency it shall be possible to discriminate effectively against disturbing line noise as distinguished from telephonic signals from the communicating station.

The Efficiency Phase.

In considering these fundamental requirements, it has always been understood that in order to secure better transmission than is obtained from the present standard substation, it would be necessary to make an important sacrifice in some other direction. In this case it could be inferred, therefore, that the addition of an auxiliary resistance element necessary to secure freedom from side tone would, at the same time, necessarily reduce the efficiency of the substation, since energy is unavoidably wasted in said auxiliary resistance. It will therefore be necessary to show that this detriment is not present in the new substation system which has recently been invented. The simplest form of substation is that in which the transmitter and receiver are connected in series with each other across the line. In such an arrangement the over-all efficiency is a maximum and the resistance of the receiver is equal to that of the transmitter. When this condition is satisfied, obviously 50 percent of the

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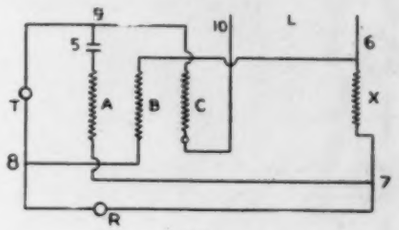

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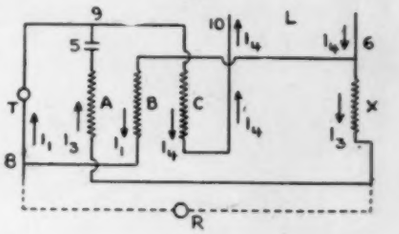

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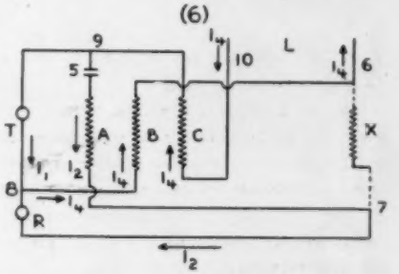


energy delivered by the line to the substation is wasted in the transmitter and 50 percent of the energy delivered by the transmitter is wasted in the receiver. Further, in such an arrangement the substation would have a very large amount of full side tone. In a proposed new substation 50 percent of the energy delivered by the line to the substation is wasted in the transmitter, but none in the auxiliary resistance, because the auxiliary resistance and the line in which it is used will be in conjugate, therefore the efficiency of the receiving apparatus is as great as that of the simple series substation. When transmitting no energy is wasted in the receiver, but 50 percent of the energy de-

livered by the transmitter is wasted in the auxiliary resistance. The transmitting efficiency, therefore, is also a theoretical maximum, and neither transmitting nor receiving efficiency is reduced by the addition of the auxiliary resistance which is absolutely necessary to secure freedom from side tone.

Requirements Satisfied.

From the above it will be seen that all of the component elements and their relation to the line are so related inside the substation that it satisfies all of the foregoing requirements.

Fig. 1 is a diagram illustrating the desirable form of the substation. Fig. 2 is a diagram illustrating the operation of the substation in Fig. 1 during transmission. Fig. 3 is a similar diagram illustrating the operation during the reception of signals. Fig. 4 is a diagram illustrating a modification of Fig. 1. Figs. 5 and 6 are illustrations representing the operation of the substation during transmission and reception, respectively.

Referring to Fig. 1, a telephone line L terminates in a substation comprising a transmitter, receiver, an auxiliary resistance, preferably non-inductive, and a transformer having windings a, b, and c. This transformer is preferably of a very high impedance and very closely coupled and the resistance of the windings of the transformer is very small. When a direct current is supplied to the transmitter from the line, a condenser may be inserted in series with the line, in order to confine the direct current to the transmitter. This condenser may be so large as to offer very small reactance to the currents of telephonic frequency, or its capacity reactance may be substantially neutralized by the inductive reactance of the winding B. In either case the capacity effect may be negligible. As shown in the drawing, line L, winding C, auxiliary resistance X, receiver R and transmitter T are serially connected. Winding B is bridged across the junction points of the line L and the transmitter T on the one hand and the receiver R and the auxiliary resistance X on the other hand, at terminals 8 and 6 respectively. The winding A is similarly bridged across the junction points of the transmitter T and the receiver R, and of the line L and winding C at terminals 7 and 9 respectively.

Referring to Fig. 2, the arrows indicate the direction of current flowing during transmission, and the dotted lines indicate elements through which no current flows. In said diagram, as well as in the diagrams of Figs. 3, 5 and 6 and in the equations and formulæ hereinafter given, the subscripts 1, 2, 3 and 4 refer to transmitter, receiver, auxiliary resistance and line, respectively. Thus, I_1, I_2, I_3 and I_4 denote the currents flowing in the transmitter, receiver, auxiliary resistance and line, respectively. In interpreting these diagrams it should be understood that the direct battery supply of current which is furnished from a central source of energy is not shown, as it merely serves to energize the transmitter. It will be clear that the flow of telephonic current as indicated by the arrows is conditioned upon the proper proportionment of the component elements of the substation in accordance with the design formulæ.

Operation Explained.

The operation during transmission is indicated in Fig. 2 and it is as follows: The actuation of the transmitter sets up variations in the resistance, which are equivalent in their action to an alternating electromotive force in the transmitter. An alternating current of telephonic frequency is superimposed on the direct current, the path and relative direction of the alternating current being indicated by the arrows. Since the substation is without side tone, no current flows through the receiver, but the total alternating current to the transmitter, denoted by I_1, flows from terminal 7, through winding A to terminal 9. Here the current divides, the portion I_4 flowing out over line L and back to terminal 8 of the transmitter, while the portion I_3 ows through winding C, auxiliary resistance X and winding B to terminal 8, where it joins the returning line current I_4. It will be clear that the transmitter current I_1 is equal to the sum of the line current I_4 and the current I_3, which flows through the auxiliary resistance X. Said current I_3 is wasted in the resistance X, but such waste is unavoidable in a circuit of this kind. If the auxiliary resistance were omitted, the equivalent waste of energy would be found in the receiver, with the further disadvantage of side tone. It will be observed that no current flows through receiver R, consequently terminals 6 and 7 must be at the same potential as regards the transmission current. This is accomplished by the proper proportionment of the relative impedance of the line and auxiliary resistance with reference to the relative number of turns in the windings of the transformer. The windings, when properly proportioned, act in such a manner that potentials are induced in windings B and C in a direction tending to increase the potential of terminal 6 to a value equal to that of terminal 7.

Relative Flow Traced.

Referring to Fig. 3, which is a diagram illustrating the relative directions of flow of telephonic current during the operation of receiving, a potential applied to the line causes a current I_4 to flow over the line L to terminal 9. This current then flows through the winding A to terminal 7, inducing current in I_1 in winding B, which flows in the opposite direction, the said current flowing through terminal 8 through winding B and receiver R to terminal 7, where it unites with current I_4, so that a current I_1, equal to the combined currents I_2 and I_4, flows through the transmitter T to terminal 8. At this point the current divides, the portion I_4 flowing back over the line, while the portion I_2 flows through the winding B. No current flows through the auxiliary resistance X when the lements of the substation are proportionate, as the potentials induced in windings B and C are in such direction and of such values as to raise the potential of terminal 5 to a value equal to that of terminal 10.

Impedance Principles.

It is a well known principle that if the terminal impedance is connected to a source of electromotive energy through a line of impedance $Z = R_4 + iR'_4$, where R_4 is the resistance and R'_4 the reactance component of the impedance, the terminal impedance must be $R_4 - iR'_4$, for maximum absorption of energy. If the line impedance has no reactance component the impedance of the terminal arrangement as seen from the line should be equal to the resistance component of the impedance elements. The condition that the substation shall have maximum energy absorption from the line is that its impedance as seen from the line shall be equal to the line impedance. Let the substation be disconnected from the line and let the impedance of the substation be measured across terminals 8 and 9, then the impedance so measured should be equal to the impedance of the line. With the line terminated at each end by a substation, the line may be replaced as regards transmission from either station by an impedance element of resistance equal to the impedance of the line. Any reactance effect, which is in practice small, can be eliminated by neutralizing reactance, and therefore need not be considered. The condition that the substation have maximum energy absorption from the line is that its impedance as seen from the line be a pure resistance of value equal to the impedance of the line. Providing electromotive force be imposed on the substation terminal equal to the impedance of the line, then the energy consumed in the substation should be equal to the energy conusmed in the resistance.

It is necessary that the line and auxiliary resistance are conjugate; in other

words, the auxiliary resistance is connected to points of equal potential with respect to an electromotive force applied to the line terminals. The impedance of the substation as seen from the line should be equal to that of the line; therefore, an electromotive force E_4 impressed through resistance R_4 on a substation whose transmitter and receiver resistance are R_1 and R_2 respectively, and the resultant currents in the line, transmitter, and receiver I_4, I_1 and I_2 respectively, the impedance across the substation must be R_4, as seen from the line and the total resistance in series with E_4 is $2R_4$, and since the current in the line is I_4, it follows that

$$\frac{E_4}{2R_4} = I_4$$

The total energy consumed may be then expressed by the formula

$$I_4^2 2R_4 + I_1^2 2R_1 + I_2^2 2R_2 = I_4 E_4 = \frac{E_4^2}{2R_4}$$

Since the energy consumed by the substation is equal to that consumed by the resistance R_4, and is therefore one-half of the total energy consumed, it follows that

$$I_4^2 2R_4 = \frac{E_4^2}{2R_4} \qquad (1)$$

This equation states that the energy consumed in the resistance R_4 is equal to that in the substation and that the substation is equivalent as seen from the line to a resistance of value R_4.

If the transmitter and receiver are conjugate the condition that the transmitter shall have its maximum output to line and auxiliary resistance may be formulated as follows: Let an electromotive force E_1 in the transmitter produce currents I_1, I_4 and I_2 in the transmitter line and auxiliary resistance, then for maximum output it follows that

$$\frac{E_1^2}{4R_1} \qquad (2)$$

Equation 2 may be interpreted from Fig. 1 as follows: Let the conductor which connects transmitter T to terminal 7 be opened and let the impedance be measured across the terminals 7 and 8, then if equation 2 is satisfied, the impedance so measured is equal to the impedance of the transmitter itself. In other words, the impedance of the combination as seen from the transmitter is equal to that of the transmitter itself.

To complete the general formula, it remains to consider the energy division between receiver and transmitter when receiving and between line and auxiliary resistance when transmitted. Let W_0 be the total amount of telephonic energy developed by the transmitter at the transmitting substation, then, by equation 2, $\frac{1}{2}W_0$ is the amount of energy delivered to the line and auxiliary resistance. Let the amount of energy taken by the auxiliary resistance be X times that taken by the line, then the amount of energy taken by the line is $\frac{1}{2}W_0\frac{1}{(1+x)}$, so that the transmitting efficiency is measured by

$$\frac{1}{(1+x)} \qquad (3)$$

Of the total energy delivered to the receiving station, let the transmitter absorb y times that absorbed by the receiver, then the receiving efficiency is measured by

$$\frac{1}{(1+y)} \qquad (4)$$

The over-all efficiency from transmitter of one station to receiver of communicating station is clearly proportional to the product of the transmission efficiency and receiving efficiency; therefore the over-all efficiency is by formulæ (3) and (4):

$$\left(\frac{1}{1+y}\right)\left(\frac{1}{1+x}\right)$$

If x and y were independent, clearly the over-all efficiency would be a maximum for $x = y = 0$. For all substations embodying these principles it may be readily shown that x and y are connected by the relation $xy = 1$. Eliminating x from the above formula by means of this relation, the expression for the over-all efficiency becomes

$$\frac{y}{(1+y)^2} \qquad (5)$$

In order to demonstrate the statement that $xy = 1$, designate the elements or branches T, R, X and L by 1, 2, 3 and 4, respectively, and let 1 and 2 be in conjugate, and also 3 and 4. Further, it will be assumed for an electromotive force in branch 4, equation (1) is satisfied, while for an electromotive force in branch 1, equation (2) is satisfied. Let S_{11} denote the current produced in branch or element 1 by unit electromotive force in branch 1, S_{12} the current produced in branch 2 by unit electromotive force in branch 1, then by the conjugacy of branches 1 and 2 and branches 3 and 4, it follows that

$$S_{12} = S_{34} = 0$$

Also, by equation (1)

$$(S_{44})R_4 = \frac{1}{4R_4} \qquad (1')$$

and by equation (2)

$$(S_{11})^2 R_1 = \frac{1}{4R_1} \qquad (2')$$

It is a fundamental principle which is deducible from elementary algebra that $S_{41} = S_{14}$. This means that the current set up in branch 1 by unit electromotive force in branch 4 is equal to the current set up in branch 4 by a unit electromotive force in branch 1. Multiplying equation (1') by R_4 and equation (2') by R_1 and subtracting, it follows that

$$(S_{43})^2 R_2 R_4 = (S_{12})^2 R_1 R_2 \qquad (a)$$

Now, in accordance with this specification the energy consumed in branch 3 is x times that consumed in branch 4 when an electromotive force acts in branch 1; therefore

$$(S_{13})^2 R_3 = x(S_{14})^2 R_4 \qquad (b)$$

Also, the energy consumed in branch 1 is y times that consumed in branch 2 when an electromotive force acts in branch 4; therefore

$$(S_{14})^2 R_1 = y(S_{24})^2 R_2 \qquad (c)$$

Multiplying equations (b) and (c) we have

$$(S_{13})^2 R_1 R_3 = xy(S_{24}^2 R_2 R_4) \qquad (d)$$

Now, from (a) and (d) it follows that $xy = 1$.

The expression given by formula (5) is a maximum when $y = 1$. This means that when a given amount of energy is developed in the transmitter at the transmitting station, a maximum amount is usefully delivered to the receiver when $y = 1$. Since this is the desired result, it would appear that the substation should be so designed. One consideration, however, modifies this conclusion, namely, the effect of noises on the line. Since the line noise originated in the line, the amount delivered to the receiver is the same as that shown in equation (4), while the amount of energy delivered from the transmitter at the communicating station is proportional to equation (5). The ratio of the latter to the former is $\frac{y}{1+y}$ and this increases as y increases beyond unity. It will be clear, then, that if y is made greater than unity the substation discriminates against line noises as compared with the signals it is desired to receive. This, of course, depends entirely upon the amount of line noise which is liable to be present. From experiments which have been made, it has been found that a desirable value for y is 1.4. With this value of y, the over-all efficiency is reduced 2.8 percent below maximum for $y = 1$, while the receiving efficiency alone is reduced 16.6 percent. However, under certain conditions it may be desirable to substantially increase the value of y beyond unity. It will be therefore understood when the value of y is referred to as approximate unity, its actual value may considerably

exceed this figure. The over-all efficiency and discrimination against line noise may be formulated as

$$R_1(I_1)^2 = yR_2(I_2)^2 \qquad (6)$$

for an electromotive force inserted in the line. In this equation y is to have a value between 1 and 1.5.

The proportioning of this arrangement of Fig. 1 is as follows: The condition that the receiver shall be conjugate with respect to the transmitter is satisfied if no current flows in the receiver in consequence of an electromotive force of telephonic frequency inserted in series with the transmitter between terminals 7 and 8. If the receiver R is conjugated to the transmitter, then the points 6 and 7 must be the same potential as regards the effect of the electromotive force. Provided the windings of the transformer have very high self impedances, the sum of the products of the currents flowing in said windings by the number of turns of said windings will equal 0. In this manner the condition of conjugacy of the transmitter and receiver is derived as follows:

Assume an electromotive force in the transmitter branch in Fig. 2 and let I, I_2, I_3 and I_4 denote the currents flowing in the transmitter, receiver auxiliary resistance and line, then since no current flows through the receiver

$$I_2 = 0 \text{ and } I_1 = I_3 + I_4 \qquad (7)$$

Also, if the self impedance of the transformer is high, representing the number of turns of windings, A, B and C, as a, b and c respectively

$$aI_1 - (b+c)I_3 = 0$$

Since $I_3 = I_1 - I_4$, this equation becomes

$$I_4 = \frac{b+c-a}{b+c} \qquad (8)$$

If K denotes the average number of turns in the transformer windings, V the potential difference across the terminals of the transmitter and R_1, R_2, R_3 and R_4 the resistances of the transmitter, receiver, auxiliary resistance and line respectively, it follows that since points 6 and 7 are at the same potential

$$V = Kb \qquad (9)$$

Also, since the impressed potential is equal to the algebraic sum of the I R drop through the line and the drop through the winding A, then

$$V = Ka + I_4 R_4 \qquad (10)$$

The negative sign indicates that the induced drop through the winding is in the opposite direction to the current flow. Since the points 6 and 7 are at the same potential, the drop between each of these points at point 9 must be equal so that

$$I_3R_3 + Kc = Ka$$

or

$$I_3R_3 + K(c-a) = O \qquad (11)$$

The several equations just derived from Fig. 2 produce the following relation which must be satisfied for the conjugacy of the transmitter and receiver

$$R_3 = \left(\frac{C-A}{B+a}\right)\left(\frac{b+c-a}{a}\right) R_4 \qquad (12)$$

where R_3 and R_4 are the resistance of auxiliary resistance and telephone line respectively.

Assume an electromotive force V applied across the terminals of the line. Since no current flows through the auxiliary resistance, $I_3 = O$ and

$$I_1 = I_2 + I_4 \qquad (13)$$

Since the albegraic sum of the products of the currents flowing through the transmitter windings by their number of turns is zero

$$aI_4 - bI_2 = O$$

Combining this equation with the preceding one we get

$$I_1 = \left(\frac{a+B}{B}\right) I_4 \qquad (14)$$

Further, since the applied voltage equals the algebraic sum of the induced drop through the winding A and the I R drop through the transmitter

$$V = Ka + I_1R_1 \qquad (15)$$

In the same manner it will be seen that

$$V = Kb + I_2R_2 + Kc \qquad (16)$$

Since no current I_3 is flowing I_3R_3 becomes zero and this expression reduced to

$$V = K(b+c) \qquad (17)$$

Finally, since points 10 and 6 are at the same potential, the algebraic sum of the drop through the windings C and A and the I R drop through the receiver is zero, therefore

$$I_2R_2 - Ka + Kc = O$$

or

$$I_2R_2 + K(c-a) = O \qquad (18)$$

The expressions derived from Fig. 3 are reduced to the following expression satisfying the requirement of conjugacy of the auxiliary resistance with respect to the line:

$$R_2 = -R_1\left(\frac{a+B}{a}\right)\left(\frac{C-A}{B+C-a}\right) \qquad (19)$$

where R_2 and R_1 are the resistance of receiver and transmitter respectively.

From equation (8) it is apparent that during transmission I_4 and I_1 are proportional to $b+c-a$ and $b+c$ respectively, and since from equation (7) it is evident that I_3 is proportional to a, substituting these values in equation 2, the condition of maximum output of the transmitter is satisfied by the following expression:

$$R(b+c)^2 = R_3(a)^2 + R_4(b+c-a)^2$$

which reduces to

$$R_1 = R_3\left(\frac{a}{B+C}\right)^2 + R_4\left(\frac{B+C-a}{B+C}\right)^2 \qquad (20)$$

Similarly, during reception it is apparent from equation (14) that I_1 and I_4 are proportional to $a+B$ and b, and since from equation (13) it follows that I_3 is proportional to a. Substituting these values in equation (1) the condition that the receiver shall have maximum energy absorption from the line may be expressed:

$$R_4 = R_2 \qquad (21)$$

So, also, by substituting these values in equation (6) we have as the expression for maximum over-all efficiency

$$R_2 = \frac{I}{y}\left(\frac{a+B}{a}\right)^2 R_1 \qquad (22)$$

Denoting $\frac{b}{a}$ and $\frac{c}{a}$ by r and r' respectively equations (19) and (22) give

$$\frac{(R+I)\quad(R+R^1-I)}{I-R^1} \qquad (23)$$

Eliminating R_2 from (19) and (21) we get

$$\frac{R^1}{R_4} = \frac{(R)\quad(R+R^1-I)}{(I+R)\quad(R+R^1)} \qquad (24)$$

Equation (23) by algebraic transformation becomes

$$\frac{I+Y}{y} = \frac{R\,(R+R^1)}{I+R\,(R+R^1-I)} \qquad (25)$$

Dividing equation (25) by equation (24) we have

$$\frac{R_4}{R_1} = \left(\frac{I+Y}{y}\right) = \frac{(R+R^1)^2}{(R+R^1-I)^2} \qquad (26)$$

Multiplying equation (24) and equation (25) we have

$$\frac{R^1}{R_1}\left(\frac{y}{Hy}\right) = \frac{(I+R)^2}{R} \qquad (27)$$

By substituting r and r' in equation (12) said equation may be rewritten

$$R_3 = \frac{(R^1+I)}{(R+I)}(R+R^1-I)R_4 \qquad (28)$$

Multiplying equations (23) and (28) we have

$$R_3 = \frac{(R + R^1 - I)^2}{y} R_4 \qquad (29)$$

By substituting r and r' for $\frac{b}{a}$ and $\frac{c}{a}$ in equations (21) and (22) and eliminating R_1 from said equation we have

$$R_3 = \frac{R^2}{(I + y)} R_4 \qquad (30)$$

If now in equation 26, 27, 29 and 30

$$\pm\sqrt{\frac{R_4}{R_1}}$$

be written as F and

$$\sqrt{\frac{I + y}{y}}$$

be written as h, then said equations may be written as follows:

$$\frac{I}{R + R^1 - I} = Fh - I$$

$$\frac{I}{R} = \frac{F}{h} - I \qquad (G)$$

$$R_3 = \frac{R_4}{y(Fh - I)^2}$$

$$R_2 = \frac{R_4}{(I + y)\left(\frac{F}{h} - I\right)^2}$$

The above group of formulae are the formulae appropriate to the substation of Fig. 1. It will be observed that in the above design formulae the winding ratios r and r' and the values of the receiver resistance R_2 and the auxiliary resistance R_3 are determined in terms of the assigned values of the line resistance R_4, the ratio y and the term F, which is a function of the ratio of the line resistance to the transmitter resistance. Consequently any desired value of F^2 or $\frac{R_4}{R_1}$ may be assigned, that is, the value of R_1 the transmitter resistance, is a matter of choice.

Referring to Fig. 4 and comparing the arrangement with that illustrated in Fig. 1, it will be seen that they are identical except for the interchange of certain component elements. Thus, in Fig. 4, the transmitter T replaces the line of Fig. 1 the receiver of Fig. 4 replaces the transmitter of Fig. 1, the auxiliary resistance X of Fig. 4 replaces the receiver of Fig. 1 and the line of Fig. 4 replaces the auxiliary resistance of Fig. 1.

The operation of the substation shown in Fig. 4, during transmission, is indicated in Fig. 5 and is as follows: the actuation of the transmitter sets up variations in the resistance which are equivalent in their action to an alternating electromotive force. An alternating current of telephonic frequency is thereby set up, whose relative direction at any given instant is indicated by the arrows in Fig. 5. The current I_1 therefore flows from terminal 6 through winding B and through transmitter T to terminal 9. A potential is thereby induced in winding A so that that current I_3 flows from terminal 6 through resistance X and winding A, to terminal 9. At this terminal the currents I_1 and I_3 join, so that a current I_4 flows from terminal 9 through winding C out over line L to terminal 6, at which point it divides so that the currents I_1 and I_2 flow through the transmitter in auxiliary resistance X as already stated. No current flows through the receiver R, this result being effected by the interaction of the transformer windings, potentials of such value and direction being induced in the windings A and B as to bring points 7 and 8 to the same potential. The action during reception is indicated in Fig. 6. Assuming a source of current variation applied to the line terminals at a given instant, the current I_4 flows from terminal 10 through winding C to terminal 9, where it divides, the current I_1 flowing through transmitter T to terminal 8 and the current I_2 flowing through winding A and receiver R to terminal 8. At this point the currents I_1 and I_2 merge and the current I_4 flows from terminal 8 through the winding B back to the line. No current flows through the resistance X as the windings of the induction coil are so proportioned with respect to the resistance of the line, transmitter and receiver that potentials will be induced in windings A and B of such value and direction as to bring points 6 and 7 to the same potential. The design formulae in accordance with which the elements of the substation of Fig. 4 may be proportioned to secure the desired results herein set forth, may be derived in a manner similar to that described in Fig. 1. Said design formulae are as follows:

$$I + R = \frac{\frac{F}{h} + I}{Fh + I}$$

$$R + R^1 = \frac{F}{h} + I \qquad (H)$$

$$R_3 = R_4 \frac{I}{y(Fh + I)^2}$$

$$R_2 = R_4 \frac{I}{(I + y)\left(\frac{F}{h} + I\right)^2}$$

High-Tension Wires for Interplant Telephone.

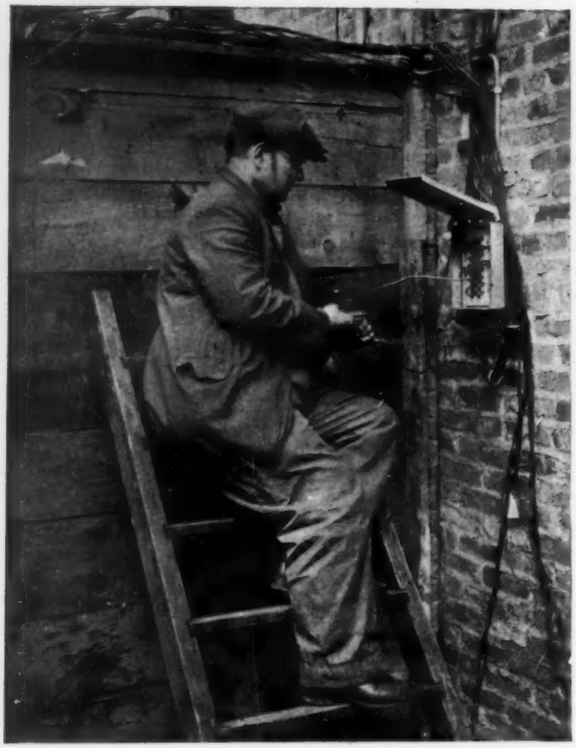
One American power company with stations at many points along the eastern coast is now able to eliminate the expense of leasing private telephone lines for interplant communication, as a result of the recent perfection, after several years of experiment, of a system for talking over high-tension wires. The principle of the wired wireless, or directed radio, is employed, it is known, and with it an apparatus for tuning out the power-circuit frequency. At the first long-distance test of the system, held between two stations in New Jersey, conversation was maintained over a live 11,000-volt, 60-cycle transmission line 12 miles long, says the Emblem. This distance was really 21 miles, however, as between transmitting and receiving sets, attached to the 2,300-volt busses at each station, were an underground cable and the windings of the two power transformers.

BACK ISSUES WANTED—Copies of January, February, March, April, 1921, and May, 1917, issues of TELEPHONE ENGINEER are needed to complete the files of prominent foreign telephone company. Subscription will be extended two months for each copy of these issues returned to us. Search your files and see what you can do in this pinch, please. Address, TELEPHONE ENGINEER, 443 So. Dearborn St., Chicago, Ill.

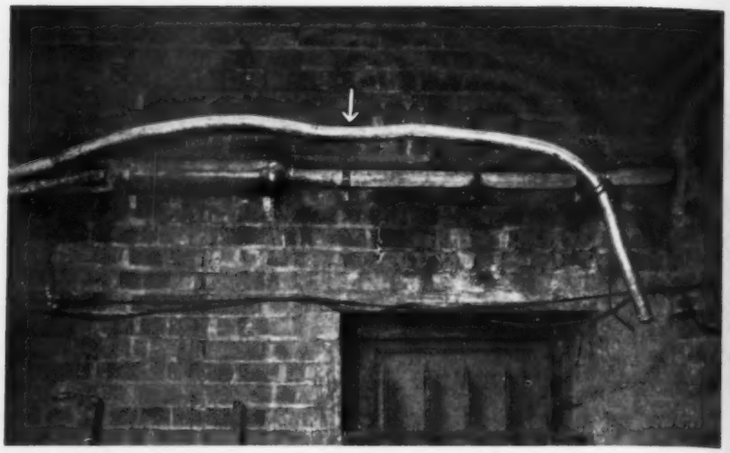
Vail's Will Disposes of $2,726,400 Estate.

New York, N. Y.—Appraisal of the estate of the late Theodore N. Vail, former chairman of the A. T. & T. Co. board of directors, sets the value of the estate at $2,726,000. His widow, adopted daughter, grandchildren, servants and educational and religious institutions figure the division of the estate.

J. Fort Cooper, formerly of Paris and Clarksville, Tex., has been appointed as wire chief for the Southwestern Bell Telephone Company's exchange at Eldorado, Ark. He has had twenty years' experience, starting in as messenger boy at Paris under O. A. Perry.



Watch this wireman cut to waste. Bridle wire is 1 6/10 cents per foot and the cost of the wire in this instance would have bought a good cigar.



This 200-pair, number 22 gauge cable is only three feet too long. The foreman measured incorrectly or hastily, for it should not have extended more than six inches beyond the splice. That means $1.50 or the price of over three pounds of butter gone to waste

Thrift Thoughts

How the Little Items Mount—An Expert's Graphic Chat on Common Wastes, their Cost and Prevention

What is waste?

It seems to be a sort of contagious disease which goes readily from one man handling material to another man. It is one of those habits of which no one is proud. It is the negative of thrift. Now a plant man can't always be thinking of avoiding waste; he must pay some attention to getting his job done. We don't want to make the mistake of losing a dollar's worth of time to save five cents' worth of material, says the New York Telephone Company in its valuable house organ, Telephone Topics, from which this sermonette and illustrations are taken.

There was a railroad boss once who was always preaching economy to his trackmen. One day he went out on the job and found a spike where his men had been working. He finally came up to the gang and, calling the foreman to one side, began: "Now, Mike, what did I tell you was a very important word?" "Economy, sir," said Mike. "Well, what does this mean?" showing him the spike. "Oh, yes, sir, we lost that and I had the gang hunting three days for it, sir. I am very sorry, sir." However, we are not very near the condition illustrated by this story. Our men, while reasonably careful of material and time, do not always appreciate the value of the material which they are using.

If a hundred helpers cut 4 inches for cotton sleeving instead of 3½ inches for a 1,200-pair splice, the money wasted ($2 a splice) would almost buy two shares of Company stock. Cotton sleeving is also being used for tying up junk, whereas spun yarn is much cheaper and should be used for this purpose

Here is a pile of junk worth about $100 recovered by the storeroom people. It was sorted and returned to stock as good material. Could we not in the first place use the material instead of turning it in as junk?

This picture shows kerosene oil, worth 23 cents a gallon, burning uselessly. Waste only half a gallon a day and the money it cost would buy a loaf of bread. If a hundred helpers did this, figure out for yourself the size of the bakery wasted

Lots of us would hesitate to throw ay a quarter or a half dollar, and we do not hesitate to throw away couple of clamps or break a screwwer handle because it is easy for us do our work if we throw away or nage a screwdriver. The thought that sting material makes it easy for us complete our work causes us to for- the value of the material which we ndle. If we had every foot of wire nped with the cost price, or if we ll our storeroom keeper hand us three llars for each roll of cotton sleeving, would be a little bit careful of all material and take a little more pains order to avoid loss.

The helper is holding on his left arm friction tape used only once, and on his right arm rubber bandage which can be used many times. Friction tape costs 55 cents a roll and if it is used in 10 splices the cost would be $5.50. A rubber bandage costs 80 cents and can be used many more than ten times. There go about ten dozen eggs!

Some one thought these were could chisel and tack lifters instead of screwdrivers and pliers. It costs 50 cents to repair a screwdriver and the pliers are worth $1.62. We could buy a good spring hat for what the Company spent in fixing these tools

The Prairie Pinch-Hitters

A Romance of "The Owners"—Dad and the Million Dollar Kid' the Heroes of a Stock-holders Tale Dev—eloped by Telephone Man from Western Incident

By "U. Jean"

You may remember the day, a wintry one. There had been something in the newspapers, a sort of garbled story purporting that on the evening thereof the scientists were going to perform a super-experiment. They were going to make a stab at sending the human voice completely around the globe by wire and wireless and record it with a receiving device on a waxen cylinder located in the very room with the person whose voice was thus to be transmitted.

A Mr. Bell, so the news stories had it, was to enunciate a brief English sentence into the transmitting apparatus, a sentence afterwards to be known as the one first heard around the world. Should the experiment succeed, the wax cylinder with the words engraved thereon would be solemnly deposited in the archives of the nation, that future generations might know that then and there—and all that sort of thing. Honest it was.

The truth of the whole business was that this had been going on for weeks. I mean talking by telephone around the world; rehearsing for the big show and the dramatic finale later to be staged for the gaping populace.

The wireless from San Francisco across the Pacific and Siberia to Petrograd needed a lot of tuning up and fooling with. And the land circuits through Europe were so rotten that the New York wire chiefs who attempted to balance them almost chucked up their jobs —almost. As for the Atlantic cables, they had about the same telephonic transmission equivalents as a 60-mile stretch of rural lines on the bottom strand of a barbed wire fence. Nothing was good but the American transcontinental line.

So the wire chiefs cut and tried, and cut and tried, and cussed and tried to get a working circuit all the way around and back again.

Nature "Spills the Beans."

Finally they did it, just as they knew they would. Of course the reporters were aware all the time that this was going on, but they are a loyal clan and kept the secret. Everything was made ready for the "big experiment."

On the morning of the day, you remember, the public was told in the early papers to brace itself for the big story. Then the transcontinental line up and fell down on the ground across three states because it had more ice on its poles and wires than the law of gravity allows.

There you are: weeks of hard work, publicity, "big experiment"—and the line lying on the ground. This called for a good deal of running around in circles and passing the buck, while the cooler heads figured out an alternative southern route for the circuit between New York and Frisco.

On that same afternoon the Denver Limited, outward bound from Fort Worth, came to a halt at a lonely water tank on the plains of west Texas. And while the engine fireman was climbing over the top of the ice-covered tender to let down the water spout, an old man came out of the warm little pump house and slowly made his way back alongside the train toward the rear end. Some of the passengers peered curiously through frosted windowpanes as the man passed by, and noted that he had a pair of lineman's climbing spurs and a coil of wire slung over his bent shoulders.

When the train had replenished its water supply and was starting, the lineman reached the rear end and pulled himself up over the brass railing and onto the deserted observation platform. There he stood, stamping the snow from his feet and eyeing reflectively the receding wintry landscape.

On the Inside Looking Out.

A gale out of the northwest that had been blowing since daylight was driving a freezing mist with it and piling a stucco of ice on all out-of-doors. The telephone wires by the track sagged down between poles like festoons of ropes, and the coal smoke from the engine, swirling back over the train, became a smudge against the monotonous white countryside.

The lounging passengers in the rear of the parlor car, for want of a better occupation, idly watched the man on the platform and wondered if he were coming in among them. Some of them hoped he would, others didn't give a snap, and a few rather resented this possible intrusion by one so uncouthly attired.

The lineman, though, bundled up head and ears, merely glanced in through the plate glass window at the warm, crowded compartment, and turned about, apparently giving no further thought to going in. He unfolded a chair and sat down under the shelter of the canopy with the air of a man taking up a careful vigil.

Presently the conductor came through and went out on the platform, where he conversed a few minutes with the lone passenger. The conductor, after collecting his fare, re-entered the cozy compartment of the car, letting in an icy draft with him to shiver his more petulant and pampered passengers.

"Who's your friend, conductor?" inquired a pleasant faced, delicate young man who was reclining in a chair before the rear window, with a suitcase between his feet.

"Dad, Me Steady."

"Oh, him!" laughed the conductor, pausing; "that's Dad; he's me steady."

The conductor went on his way. The young man unfolded a newspaper and reread a certain story with new interest. Dad, out on the platform, had lighted his pipe and sat smoking and watching as the train labored on its journey through the storm.

After a bit the young man got up, put the paper in his pocket carefully, drew on a fur-lined great coat, and, picking up his suitcase, went out on the wind-swept platform with Dad. The other passengers watched this little play and wondered what the actors in it were going to do next.

The young man paused a moment, undecided, swaying with the motion of the train. A shiver ran through his slight frame and he coughed a bit, maybe only to attract the attention of the other.

He put the suitcase down and sat on it, and began speaking the lines of the play: "I say, Dad, won't you come inside and get warmed a mite? I'll sit by for you."

The older man looked around, smiled tolerantly, his gray, kindly eyes lighting up friendly-like. He rubbed some icicles out of his moustache and reply slowly, "No; much obliged. I reckon I'll stay here for the time."

"They call this the Sunny South," the

young fellow persisted. "It looks more like Vermont to me." The roar of the wind made conversation rather difficult.

Hope That Springs Eternal.

But Dad leaned over and said, "You'll see the sun yet, if you stay long."

"I hope so," replied the talkative youth. "I was just reading in the newspaper about your telephone people tonight."

Dad looked around with quick interest, but only nodded his head and said: "Yeah!" with the rising inflection.

"Don't suppose it affects you?" questioned persistent youth.

"Me!" ejaculated the lineman. Dad raised his left arm and pointed back at the ice-covered wires stretching down the track. "Them's the boys," he said with brief emphasis.

"My name is Fontaine," said the youth, dragging his suitcase nearer and holding out a hand of friendship.

"You seem to know me already," laughed Dad in a way that older men have with upstarts, as they shook hands.

The next minute Dad and Fontaine found themselves flat on the floor of the platform and sliding up against the end of the car. The emergency brakes had suddenly been jammed on, and the train was grinding itself to an abrupt stop.

The train came to a standstill with the engine wheels spinning backwards, the fireman standing on his head and the passengers extracting themselves from all sorts of ridiculous positions.

Dad Gets Wise.

Dad, mad clear through, crawled over the railing and dropped to the ground. He started up ahead with his coil of wire and spurs. Fontaine, not knowing what else to do, followed suit, lugging his suitcase.

At the head-end of the train Dad and Fontaine found the engine crew talking to an excited cowboy whose horse stood close at hand.

The cowboy was telling over and over again that an operator had just telephoned him from White Deer that a box car had got loose out on the main line and was coming down the ten-mile stretch of track, propelled by the northwest gale. The cowboy had ridden from a nearby ranch house to break the news.

There wasn't a lot of time to be lost—there never is in short story action. So the engineer and firemen appointed themselves a committee of two to receive the box car in due form. They started up the track with a derailing device.

By the time the usual crowd of passengers had gathered around the engine for information the runaway car hove in sight and came racing down the track with the wind as if it were past due somewhere.

"Hell to Pay."

Here was a thrill, something not on the program, and the crowd scattered. The oncoming car, when scarce a hundred yards away, reached the derailing frog. There was a heavy, crunching jar. The car staggered drunkenly and dashed, a pondrous bulk, from the rails and down the slight incline. The car reared up on one end and fell bottom upwards through the telephone toll lead, ripping the poles and wires about it into a tangled mass. There was a great clattering of ice, hurled upward from the broken wires.

While the crew was making minor repairs to the track the cowboy mounted his pony and disappeared in the thick air. Some of the passengers gathered souvenirs, while the others scurried to the coaches for the best seats. After a bit the train proceeded with all on board, all save two.

These two stood surveying the jumbled wreckage of the wires, now barely visible in the fast falling darkness of an earl ywinter's evening. For a half-mile the poles had been broken of and jerked down by the strength of the forty wires.

"Well, Daddy, it looks as if the big experiment was all off for the evening, doesn't it?" inquired Fontaine lightly.

Dad faced about angrily. "What's your idea, kid? After me trying to hire everybody on that train to help me, you stay?"

"I heard you trying," replied Fontaine, "and decided to stop over and see it through with you. I am one of the owners, you understand."

"Owners of what?"

"The business, sir." Fontaine was flippant.

The Owners Get Busy.

Dad eyed him and said grimly, "You'll be one of the workers, kid, for the next few hours."

Then Dad adjusted the responsibility of the situation on his dependable old shoulders, and the service was in a manner of getting on its feet again. Dad's instructions to his helper, the owner, were brief, and thereafter the youth and the man fell to the task before them.

For the next three hours these two wrestled in the dark with the half-mile tangle of wires and cross-arms and broken poles. They untied wires, and pulled them, and cut them, and dragged them, and piled them and swore at them and at each other, until their hands were raw and their bodies numb through with the cold.

When the job was done, all of the cross-arms and wires were lying back from the track in a snarled windrow of junk. That is, all of the wires save two. These two wires were No. 8 copper, and lay spliced and intact, paralleling one another for three thousand feet, insulated on the hard, dry ice that was fast encasing them. They were a working circuit and constituted the last—and not the weakest—link in the chain that circled the globe that night.

Awaiting the Zero Hour.

Dad drew a small hand test set from his pocket, nervously fastened the clips to the two wires on the ground, and, holding his hand over one ear to shut out the howling of the wind, strained the receiver to the other ear.

Fontaine sank down by his suitcase, tired out, and shivered and waited.

"The line is working," shouted Dad excitedly as he stood on his knees and over the two wires. "I can hear the test-board men in Frisco and New York—they're talking to France—they've got it connected all the way around, now." Dad was silent, listening for a brief time; then he detached the test set and stood up with his back to the wind.

"For God's sake, build us a fire, Dad," pleaded the younger man, straining for a sight of his companion in the darkness.

Later, when the two were huddled about the cheery blaze sheltered behind the overturned box car, Fontaine asked: "Could you hear what Bell had to say around the world?"

SUCCESS TALKS

CO-OPERATION

By S. A. CHANDLER

We are just beginning to capitalize co-operation. A very few years ago two firms engaged in the same business, looked upon each other as rivals to be beaten, to be slandered and run down as enemies. To boost your rival was thought to injure yourself.

The same point of view held forth within a company. The boss looked upon labor as something that was bought by the dollar's worth, and his aim was to get one dollar and ten cents' worth of labor out of every dollar he gave in wages. He thought little of the comforts or the personal views of those who worked under him; and those who were in his employ gave him as little as they could during the hours that they contracted to work in his plant. They had less interest in the success of the business than in getting as much as they could for as little as they could give in return, for they looked upon their boss much as he looked upon a business rival.

But those days are swiftly passing. We are now beginning to learn that down in our boots we are all human beings, with human feelings and human impulses. We all respond very quickly to consideration of our opinions, to kindness and to trust.

Rival firms are daily learning that when they knock one in their line of business, they hurt that business. Also, that more and more business men look with disfavor upon those who knock.

Likewise capital and labor are beginning to see the light. They are learning that neither prosper when their best energy is spent in antagonizing each other. They see that each is necessary, that one without the other will produce nothing. They are learning, too, that neither can expect, as long as men have hearts and think individual thoughts, to rule over the other. Their only salvation is in getting together; in each conceding a point; in working WITH instead of AGAINST each other.

Knocking gains nothing; but co-operation wipes away all traces of malicious opposition and gains—co-operation.

(Copyright, 1920, by S. A. Chandler)

"Yeah!" replied the lineman, fishing in his pocket and pulling out a leather wallet. "I got some interest in this outfit, too," said the older man, a bit sheepishly.

Pockets Full of "Change."

"Have you?" laughed Fontaine with the irreverance of youth. "Well, Dad, I have a little over a half million dollars' worth of the stock in this suitcase."

"You're a fool," exclaimed Dad, striving not to show undue interest.

"I was afraid to let it get out of my sight," Fontaine defended himself a bit soberly.

"I'm paying out four more shares," continued Dad simply, as he cut up some tobacco for his pipe.

Fontaine was watching the lineman's gnarled hands and thinking of the night's achievement.

"Dad," he said, "do you think I could get some kind of work to do out around Santa Fe? I could learn, and I need to keep my mind off of things," he coughed again slightly.

"I reckon you might," replied Dad, reaching for a coal of fire. And both men were silent, waiting in the night for someone to come to their aid.

It's Done When Possible. Arnold, Neb., Co. Asks Reduction.

Arnold, Neb.—The Arnold Telephone Co. asks that it be permitted by the commission to reduce its rates sufficiently to cut its gross earnings $400 a year. The application sets out that the earnings in 1920 were $5,968. The company paid an 8 percent dividend and had a surplus left. It now declares that it is building up too much of a surplus and that it desires its subscribers to get the benefit.

The application will probably be granted.

Selling Service.

Selling service simply stands for spreading satisfaction
Seeking to support system, and study speech sincerely
Supplanting scoffs and sneers by smiles and such suggestion
Satisfying subscribers and soothing the same remedy.

—Telephone Topics.

Weather Reports Via Phone in Vermillion County, Illinois.

Danville, Ill.—Vermillion County Telephone Co. now is giving official government weather forecasts to rural subscribers who call "Information." The service has made a great hit.

OIL'S PHONE LINES.

Vital Need for Close Contact Causes Building of Big Systems.

Fort Worth, Tex.—More important than any other factor in the high position of the oil industry today, and less understood by the outsiders to the game than any other factor, is the magnitude of the telephone systems of the larger petroleum concerns in the Mid-Continent oil fields. To enable a big financier "back east" to take down a receiver in a company office or station in Marion county, Kansas, and speak personally to an employe or official in the Eastland, Texas field; to confer back and forth between Tulsa, Fort Worth, Dallas, Kansas City and Wichita many times a day, with scarcely a minutes' delay—that's service and that's what the big companies pay for when they spend hundreds of thousands of dollars a year in establishing, equipping and maintaining their elaborate wire systems.

It isn't a hobby with the big oil concerns. It is probably true that the oil business demands quicker and more accurate communication and co-ordination between its parts than any other. It's a necessity for the successful prosecution of their business, and it's paying, and has paid big. Constant and complete touch with a vast, easy running organization is one of the beauties of the system in use by numbers of the big companies. They're ready always.

This is one of the ways the old business maxim is true, that "the bigger they get the more they make." They make more than proportionate to their size, and this system of wire communication, which usually the smaller companies cannot afford to use, is one of the very good reasons.

For the smaller company it is comparatively easy to see a scout or even a high official trying to reach a representative at a certain field with orders to "sell while the selling is good." He flounders along, maybe on foot, maybe in a hired livery outfit, or even maybe through the mud in a high powered company car. But no matter how good the roads or how swift the car, the big company has the jump on him. An officer will write out a message and—flash! the representative gets it and sells at once! The ability to do what you want to when you want to amounts to more in oil than is dreamed of in other lines of enterprise. The Empire Gas & Fuel Co., big producer in Oklahoma, Kansas and Texas, has a representative wire system, one of the best. The company's system was started eight years ago, first being limited and used only by the gas division in southern Kansas and northern Oklahoma to help in regulating the demand and supply in the company's gas service. Difficulty in keeping in close touch with scattered foremen, loss of time and loss of money, were responsible for the institution of this big private system.

For the Empire the big demand for service came in the days of Eldorado, when the company began getting the big wells in the Enyart, Cardy and nearby leases. The wire system grew an enforced growth—several hundred percent—and it was required to do it in virtually "nothing flat." Today the company has nearly 30,000 poles, thousands of miles of wires, and a big gang of workmen. From Kansas City to central Texas the system extends.

In oil the big deals must be "put over" in secret, more or less. Here the private wire scores, according to the correspondent of the Texas Oil Ledger, whom we quote here. The outsider does not get in and the inside information doesn't leak out—at least, not through the wires.

Even more far-reaching is the service of the parent Gulf Oil Corp. with its children, the Gypsy Oil and the row of Gulf companies. The Gypsy itself has two private wires stretching from Pittsburgh, Pa., the home of the company's controlling interests, to Tulsa, and stretching out from there to scores of scattered places. Each of the companies under the Gulf have their systems.

Ease of extension of the systems into new districts speedily is one of the good points for the service. It frequently is necessary to employ dozens of extra workers and string wires to houses, trees and oil rigs, later replacing with permanent poles and leads. In such cases the greatest care is taken to see that there is no way to attach "spy" wires which might be dangerous to the privacy of the wire.

The Prairie Oil & Gas Co., big Mid-Continent producer and foremost Standard Oil crude purchaser, maintains a vast wire service from its Independence, Kan., main office. Even the smaller among the larger organizations have found the private wire systems more than pay. Full private service is maintained by such concerns as the Carter Oil Co., Empire Gas & Guel, Gypsy Oil, Prairie Oil & Gas, Cosden & Co., Marland Oil, Phillips Petroleum, Texas Co., Humble Oil & Refining, the Roxana interests, Oklahoma P. & R., White Eagle Oil & Refining, Sinclair Consolidated, Pure Oil, Magnolia Petroleum, Atlantic Refining, and dozens of other companies both large and small.

Railroad Telephone Practice

New York Central Telephone Engineer Concludes Notable Series—Figures on Energy Consumption of Selector Circuits

By Stanley Rhoads
(From Paper Read Before A. I. E. E.)

Inductive Disturbance in Telephones from Differential Sets.

It is the experience on the New York Central Lines that differential operation on some classes of circuits causes considerable induction in adjacent circuits, in some cases interfering to a serious extent with the operation of telephone circuits carried on the same pole lines. The increasing number of multiplex printer circuits which are differential-operated increases the disturbances.

Bridging duplexes do not seem to cause appreciable difficulty of this nature, but the speed of operation of the bridging sets may not be as high as with differential working. Certain tests have shown that the differential system is satisfactory from an induction standpoint on paralleling telephone circuits when used on composited phantom wires, that is, on the Morse legs of two pairs making up a phantom of which each pair gives one Morse circuit; also on Morse circuits made up of each of two wires which form a long-distance telephone pair. It is the intention, therefore, to use the differential system on composited wires and the bridging system on simplex and single wires, on the New York Central Lines. However, it is apparent from some oscillograms taken that bridging sets can be speeded up when used on composited circuits by removing the condensers and coils in the Morse legs of the composite sets, but because the efficiency of the differential is higher and the polar relay in it gets more current at lesser operating voltages it seems preferable to use differential on composited circuits. The lessened voltage results in lessened disturbance in the telephone branch of the circuit.

Oscillograms No. 458 and No. 459 of Fig .37 show the outgoing and incoming waves on a circuit made up of a 280-mile loop of simplexed telephone lines equipped with Western Electric Co. straight step-up selectors, consisting of two so-called "high resistance" simplexes—one 140-mile No. 8 B. W. G. iron pair, and the other 140-mile No. 9 B. & S. copper pair—connected together without repeaters at the junction point. That is, the circuit was arranged with two duplex sets at Indianapolis, Ind., on two simplexes to Springfield, Ohio, where the simplexes were tied together without repeaters. This permitted simultaneously recording both outgoing and incoming waves at Indianapolis. The sharpness of the differential waves in trace No. 1 of No. 459 is noticeable, compared with the more rounded wave of trace No. 1 of No. 458, which is the bridging duplex. The duplex sets used were standard Western Union instruments, installed according to that company's specifications. The simplex coils were Western Electric Co. No. 46-A with No. 34-B non-inductive resistances added between the No. 46-A coil and the line.

A number of records were made to see if a differential set at one end of a line and a bridging set at the other had any effect upon the operation of the circuit, but no detrimental effect could be noted. One point noted was that the received wave is the same shape in both differential and bridging circuits. The sharp peak of the outgoing differential set is absorbed by the line, upon simplex and composites at least, which were the kind of circuits tested. This is illustrated in trace No. 2 of No. 567 of Fig. 35 for bridging set, and No. 568 for differential set, which were taken on a low-resistance phantom composite loop of Fig. 11. These two circuits were 140 miles each, No. 9 A. W. G. copper dispatching and message lines. Points *a* and *b* of Fig. 11 were connected at the Bellefontaine end, making a loop, Indianapolis to Bellefontaine and return. All the composite and telegraph equipment was cut off at Bellefontaine.

The effect of the grounded capacity and half No. 5-AA retard coils in the Morse legs was noted by cutting them out and taking No. 569 bridging and No. 570 differential, other conditions being the same as Nos. 567 and 568.

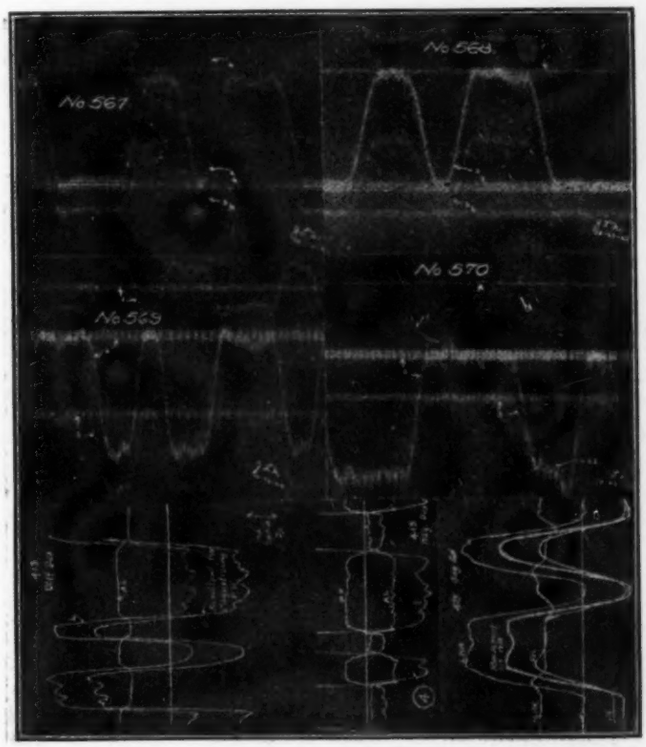


Fig. 35

In Nos. 567 and 568 trace No. 1 is the polar relay current, and trace No. 2 is the line current at the receiving station. In Nos. 568 and 570, No. 1 is an artificial line current and No. 2 the line current at the receiving station. Comparison of Nos. 567 and 569, bridging sets, indicates that the half No. 5-AA coils and six-microfarad condensers, as used in No. 567, appreciably round off the waves and slow up the circuit, and that they can be dispensed with and yet obtain fairly smooth waves as in No. 569. Comparison of Nos. 568 and 570, differential sets, indicates the necessity of having these coils, as No. 570 has rather sharp waves. No. 568 indicates that the differential waves are rounded out enough to prevent induction.

An interesting exhibit is shown in No. 463 and No. 464, which are records made on two working multiplex printing telegraph circuits. The No. 463 was taken at Indianapolis on a Chicago-Louisville multiplex wire, and No. 464 was at Indianapolis on an Indianapolis-Cincinnati multiplex wire. It is evident that No. 464 was being operated as a differential set, and it is probable that No. 463 was also, but as the record was made at the middle of the line, the waves are somewhat rounded off. No. 464 illustrates why induction is heard on telephone circuits from these multiplex circuits with their sharp waves.

Records No. 403 and No. 404 of Fig. 37 show the result of 25-cycle induction from a single-phase trolley line on duplexes, used on a composite leg of a No. 9 A. W. G. copper, low-resistance phantom, Indianapolis to Cincinnati, 110 miles. The trolley line parallels the railroad from Indianapolis, 40 miles toward Cincinnati. The No. 403 is with duplexes with 500-ohm resistance in place of the No. 5-U coils. Trace No. 1 is line current, trace No. 2 is artificial line, and trace No. 3 is the polar relay. The No. 404 is the same as No. 403, but has No. 5-U coils, which greatly amplify the induced waves, but the net operating current in the polar relay is about the same in both. The effect of an induced wave, if it should occur at a time of zero current in the polar relay, might cause false signals, with the No. 5-U coil set.

The investigations indicate that the one-microfarad condenser in duplex and quadruplex sets at the vertex of the No. 5-U retard coil has but slight bearing on the wave shape of the circuit and is chiefly advantageous as a spark eliminator at the pole-changer contacts. Six microfarads were tried without noticeable effect.

It is noted in the bridging quadruplex that the holding condenser current affects a loop consisting of the condenser, the holding relay, line relay and bridge relay. No effect of it can be detected in the line, the artificial line, or in the No. 5-U coil.

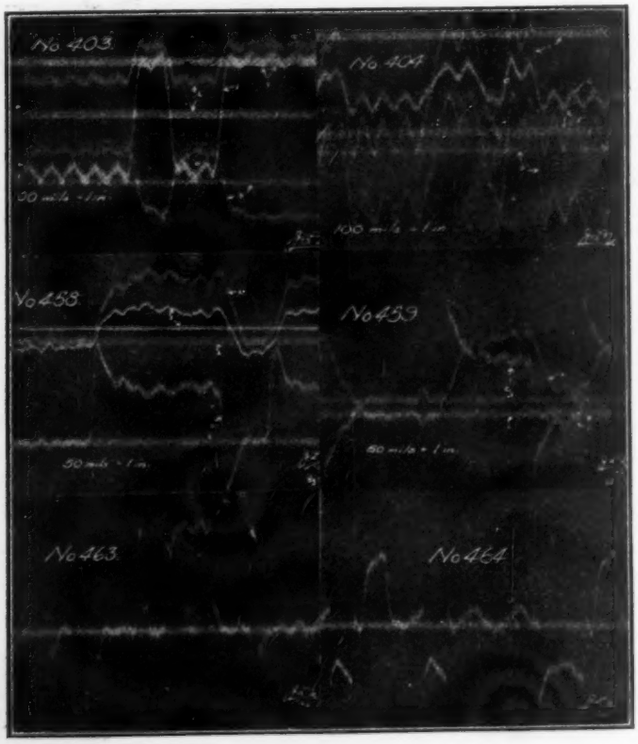


Fig. 30.

The "bulge" of the polar relay current is noted in both the duplex and quadruplex. In the quadruplex this is confined to the above mentioned loop, consisting of the holding condenser circuit, line relay and bridge relay. In the duplex it is seen to a limited extent in the line and in the No. 5-U coil.

Telephone Transmission Distances.

Experience indicates that the railroad service requires ten-mile telephone transmission or better for dispatching, message and long-distance lines. Dissatisfaction results if the equivalent in miles of standard cable is much greater than this. This shows that the railroad demands better transmission than is considered satisfactory in commercial service. From the standpoint of practical results and satisfaction to the users of the railroad telephone lines the following has been noted:

No. 8 B. W. G. iron for long-distance lines should not exceed 50 miles of line; for way-station message telephone lines using railroad telephones, 75 miles.

No. 9 A. W. G. copper for long-distance lines should not exceed 150 miles; for dispatching and message lines, 225 miles; for phantom composited, 150 miles.

No. 8 B. W. G. copper for long-distance lines should not exceed 300 miles without repeaters.

The above figures are based upon average conditions such as obtain upon the New York Central Lines, and take into consideration that some of the P. B. X. stations are a considerable distance from the P. B. X. which limits the transmission distance because of the loop losses. Circuits are frequently used of longer distances than the above, but at a sacrifice in efficiency and with some annoyance to the users.

The railroad telephones as used on dispatching and message lines produce considerably more volume of transmission than standard P. B. X. station telephones, and therefore have greater transmission distance, which experience indicates is 30 percent greater than the standard P.B.X. stations for equal volume of received transmission.

The author wishes to express his cordial appreciation of the extensive assistance rendered by John L. Niesse, telegraph and telephone enginer, C. C. C. & St. L. railway, in making the oscillograms and for other assistance in preparing data for this paper, and to Prof. C. Francis Harding, head of the School of Electrical Engineering, Purdue University, for the use of the oscillograph.

OPINIONS AND COMMENTS

GET TOGETHER.

From Oregon comes word that the Public Service Commission has asked the public utilities to carry forward all possible work with the aim of helping to solve the unemployment problem.

Illinois also registers with a report of a speech by Samuel Insull in which this public utility genius says, "unintelligent politics is retarding the expenditures that Illinois public utility companies ought to be making right now, for new construction work, at the rate of $75,000,000 to $100,000,000 a year—all for labor, material and supplies."

There are men—thousands of them—eager for work, in Illinois and other states. How long will it be before the politicians get together with the states' public utilities, and back a request like that of Oregon's with some substantial encouragement.

FORBES' VIEW.

B. C. Forbes, fearless, fluent, and Wall Street wise, is the most widely read financial writer in the country. No one has ever even intimated Forbes could be "reached." He damns or praises strictly according to his own lights, and penetrating bright lights they are.

It is cause for congratulation that Forbes wrote of a telephone company for the New York American, in this fashion:

"The truth is that the American T. & T. Company is managed by honest men, by men who attend to their business, not to the stock ticker.

"The telephone company indulged in no spectacular distribution of special dividends during the war, but kept on the "even tenor of its way." Its earnings increased with the increase in its business, and by conserving its resources it is now in enviable financial condition as contrasted with concerns which lost their heads during the delusory war boom. By paying a dividend sufficient to attract imperatively needed additional capital, the management are confident that American's telephone service can be kept up to standard and improved in the future as impressively as in the past. "Give us the necessary funds and we will give you the telephone service you demand," is what they say. And they add that they have complete confidence that the public will approve this policy.

"Truth is mighty and will prevail." The Associated Press head, Melville Stone, in his memoirs tells how that costly phrase, "The public be damned" was unjustly attributed to a public service official.

Bankrupt bolshevism is planning to send out an S. O. S. for capital says a cable. On this call Lenine stands a good chance of hearing the busy signal.

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ADVERTISING

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CARTY'S "FAIRY TALE."

"The telephone system that is coming, that nothing can stop from coming, will be one that will make our modern world over," J. J. Carty the telephone engineering wizard states in a New York Herald interview.

The reporter remarks that Carty's vision of telephony is like a fairy tale.

What fairy tale could compare with this vision of world telephone system that "will make necessary to all nations the use of a common language which will join all the peoples of the earth in one brotherhood?"

The earlier authors of fairy tales were content with a limited dramatis personae, Carty's "fairy tale" takes in the world. The old writers were content with mere fancies, Carty keeps going till a fancy's a fact.

YOUR BY-PRODUCTS.

Making every cent invested in telephone equipment do money-making work all the time, is an ambition worth nursing.

Classes of service that afford opportunities for intensive profitable development, notably toll business, are getting a deservedly strong push these days.

Fire and burglar alarm business comes in the class of by-product business that will bring in a respectable revenue for a modest investment. This equipment has reached a high stage of development, and holds itself ready for the manager who misses no chance to add to the profits of his operations.

Hammondsport, N. Y., subscribers petition for increased rate to assure continuance of good service. Ten pages and the pen of a genius couldn't carry a better editorial on service than that one sentence.

Philly Introduced to Dial

Keystone Telephone Company of Philadelphia Is Now Operating More Than 47,000 Telephones By Strowger Automatic System—Well Planned Change

Philadelphia, Pa.—After many months of preparation the Keystone Telephone Company's plant was switched to Strowger automatic operation May 4. More than 47,000 telephones, served by six offices, were affected by the change.

As the Saturday evening traffic died down at the "switching" hour of ten, as one official of the Keystone Telephone Company termed it, groups of men, some 300 in all, were gathered at the automatic switchrooms under the supervision of expert engineers, and as the signal was given in each office simultaneously, the insulating strips were pulled.

During the cut-over process, the men in each automatic switchroom were in constant communication with the manual switchroom. As fast as the insulators in each automatic office were withdrawn, the line cables at the corresponding manual switchboards were cut, thus entirely disconnecting the manual equipment from the subscribers' lines. The complete transfer of service was accomplished in less than five minutes.

Try-Out Traffic High.

The traffic immediately began to flow into the new equipment, and for several hours after the cut-over, and on Sunday also, the traffic was abnormally high for non-business periods. On Monday again, with the resumption of business, the amount of traffic handled was astonishingly high, but at no point was there any difficulty experienced.

Guests assembled in the various offices at the time of the cut-over were unanimous in their expressions of approval at the quiet, efficient way in which the switches were handling the calls. Other evidence as to the excellence of the service came from a dozen reporters of the staff of the Philadelphia Enquirer who were out making test calls after the cut-over.

The Keystone company had some problems to be solved that were peculiarly its own, for instance, the unusual high ratio of private branch exchanges found in the Keystone system; also the very high calling rate which is encountered. By reason of the fact that the Keystone carries a large percentage of business messages in Philadelphia and is almost exclusively an unlimited service, the load carried is unusually heavy and there are very sharp peaks at different hours of the day. An exhaustive survey of the field was made and it is believed that nothing has been overlooked that might tend to add to the perfection of the service.

The calling device of the Keystone system shows all local calls are now handled automatically. For the present, the manual switchboard is retained at Camden, the operator at which point is reached by dialing 9.

Long distance and service desk equipment is centralized at the Race office, and each position has been equipped with a calling device so that long distance operating expense is reduced to a minimum, and tecting and handling of complaints accomplished more efficiently.

Publicity Extensive.

Publicity covering the cut-over was unusually thorough. The printed matter was supplemented by many lectures and lessons.

The Keystone company has 1,400 private branch exchanges in its system. Every operator in these exchanges was invited into the main office—25 or 30 of them a day—and given a luncheon and a demonstration of the automatic telephone and its relation to the switchboard. Every one of them has been visited since the installation of the system and all are said to be for it.

A large corps of young women with telephone instruments equipped with dials was sent out to make a house-to-house canvass. These young women demonstrated to anyone and everyone they could get to listen. They did not try to sell. The company followed them and their card reports with 60 salesmen who demonstrated and took subscriptions.

An interesting detail of the campaign was a series of addresses to various organizations throughout the city by trained talkers who had with them demonstrating apparatus. These addresses were delivered at dinners and lunches and sometimes at called meetings. It is estimated that nearly 200,000 people were talked to "face to face" in this way.

Edward M. Cooke, general manager of the company, in speaking about the reception accorded these speakers, said: "I have never known anybody with something to sell to receive so general and cordial a welcome. I believe the experience is absolutely unique."

Telephone operating men and engineers from all parts of the country were present at the cut-over, the magnitude of the undertaking being a great attraction.

Notables Present.

Officials of the Keystone Telephone Company who were present when the transfer was made included Nathan T. Fowell, president; Edward M. Cooke, general manager; and Joseph F. Stockwell, operating manager.

Among the out-of-town visitors were G. W. Robinson, president W. I. Howard, superintendent of traffic, and O. A. Knell, superintendent of plant, Tri-State T. & T. Company, St. Paul, Minn.; G. S. Herbert and C. L. Baer, Cumberland Telephone Company; C. W. Felix and F. G. Donnelly, Northern Electric Company, Montreal; John H. Wright, Jamestown Telephone Corporation, Jamestown, N. Y.; Carlos Siler, Cuban Telephone Company.

The Automatic Electric Company, which manufactured and installed the equipment, was represented by H. L. Gary, vice-president; W. F. Benoist, assistant general manager; E. C. Blomeyer, general sales manager; W. S. Vivian, manager service and traffic development; T. G. Martin, chief engineer; F. L. Baer, contract sales engineer; Roy Owens, W. J. DeVoe and Frank Holmstrom, Jr., of the sales department; and T. E. Meyer, Fred R. Quayle and James Engh, of the engineering department.

Special commendation has been given the work of the installation department of Automatic Electric Company, particularly that of H. P. Mahoney, assistant superintendent of installation and operation, whose painstaking efforts were responsible for the spirit of co-operation that existed between the various parties concerned. Mr. Mahoney's thoughtful endeavors will be long remembered by those with whom he came in contact during the time of preparation for the cutover.

Forest Phone System to Be Enlarged.

Baker, Ore.—Malheur and Ochoco forest service districts are to be connected by a 50-mile telephone line as an aid for forest fire-fighting.

Rate Changes Force Billing

Sudden Grants of Rates Make Telephone Billers "Step on 'Er" to Get Billings Out on the Dot— St. Paul and New York Hang Up Great Records

These eleventh hour grants of rate increases have given accounting departments something to worry about—that is, if time permitted any worrying.

Two conspicuous cases of accounting departments racing against time and winning the heat, come from the Tri-State at St. Paul and the New York Telephone Company.

The St. Paul story of the record-smashing billing achievement as told by L. R. Welliver, auditor of receipts, in the Tri-State's breezy journal, The Emblem, mentions the following features:

The new tariffs were received from the Commercial Engineer about 4 p. m., Thursday, March 26. It was necessary to change the rates on 73,471 bills and have them ready for delivery on Thursday, March 31. This gave us six days to complete the job.

"In order to accomplish the task in the limited time, a preliminary plan was laid out before receiving the new rates from the Commercial Engineer. Subscribers' service cards were sorted into six classes, B-1, B-2, R-1, R-2, PBX systems and specials. The first four classes were, while representing the larger volume of accounts, comparatively easy to change. The last two classes were the hard ones to handle. The PBX systems were sorted into their five natural classifications for easier handling. In doing this work, it was necessary to call on Mr. O'Brien, Mr. Mulbarger and Mr. Carlson of the commercial department, who gave us commendable assistance in all PBX classifications and in the application of rates to this class of accounts.

Complaints Eliminated.

"It was decided to mail a detailed statement of the rental charges on private branch and automatic exchanges to the subscribers renting that kind of service. This was done to eliminate inquiries from the subscribers and to facilitate the handling of any inquiries that might be received. We have been told that this detail has been effective and that the extra time taken to furnish the information has more than paid in speeding up collections and adjustments.

"The special rates covered the folowign classes of subscribers: Employes, city and government accounts, charities, private lines and foreign exchange service. The work of revising these rates was assigned to special clerks who were familiar with the accounts of this kind of service.

Each Bill Changed.

"When the cards of all the subscribers had been changed as to rates they were sorted back to their original numerical order of telephone numbers and the work of changing the bills begun. Each clerk was provided with a rubber stamp bearing new rate and a blotting strip so that by one movement, the new rate was put on and the old blotted off of the bill.

"The bills were sent out on schedule time by the whole-hearted co-operation and extra work of the employes of the department and willing aid from members of the commercial department, for which we take this opportunity of thanking them."

New York's Task.

Making up a half million bills to subscribers in less than ten days was the gigantic task the New York staff faced. A half million bills had been practically completed when the temporary increase was granted. The company's journal says:

"The accounting department has never fallen down on getting its bills out on the first of the month, and it didn't on this occasion, even though all the odds were against it as to time. A rush order was sent to the printer for half a million new bill forms, enough to take care of the needs of the Murray Hill, Harlem and Long Island accounting centers. A small army of messenger boys, as well as plant and delivery trucks, were brought into service to cover the stretch between the printers and the various offices.

"As fast as the printer could turn out the bills they were rushed to the workers ta the offices and not a second was lost in starting up the machinery which had been stopped so suddenly. On Saturday, the day following the announcement of the rate change, the addressograph machines began their steady chugging, and gradual devouring of the heaps of bills just delivered. These machines ran from Saturday morning to Monday afternoon, Sunday included, continuing in eight-hour shifts without stopping.

Work Without Trimmings.

"The change necessitated copying part of the data from the bills which had already been made out for the old rates, as well as writing a new set of figures on the enw bills and ledger records. (In one of the offices even the division auditor himself was computing twenty percents as fast as he could).

"It would take a long while to learn all the tricks of the accounting work—the time-saving devices, the various charts and machines to do rapid figuring, et cetera. At Murray Hill we noted a ticket measuring box invented by one of the workers to count tickets by heaps for rough estimate purposes. At a ticket counting machine a girl was slipping toll tickets through the mechanism more quickly than one can slip through a pack of cards with his thumb.

"The workers are all divided into units with supervisors for each one. In one section several girls were adding toll charges on a comptometer, their fingers going at a presto tempo. Another unit was busy checking and verifying every bill and statement, for accuracy in everything is vital.

"The final step was performed by envelope-sealing machines which lick the entire amount in one day. It takes three girls to take care of the sealed envelopes as they are turned out.

"In the Brooklyn office these bills filled 65 or 70 mail bags (stuffed full). The stamps for this one month's bills alone were too heavy for one man to carry. Two automobile trucks rolled up on March 30, took the many bags of mail, and the deed was done. At 10 o'clock on the last day of the month every bill was in the postoffice."

Stands "In Right" with More Than 151,000 Owners.

New York, N. Y.—The new $90,000,000 stock issue of the A. T. & T. Co. will not be underwritten. An additional investment of approximately $600 apiece on the part of the Bell's 151,000 stockholders will absorb the issue.

Allowed to Abuse Operators Once—It's Enough.

Jefferson City, Mo.—When service is unsatisfactory, a subscriber has the right to abuse the operator once, according to a ruling of the state authorities.

NEWS FROM FOREIGN LINES

AUTOMATIC ABROAD.

H. E. Clapham Tells of Installations in So. America, India, and Elsewhere.

Considerable attention already has been given to the Automatic installations which have been built, or are in course of construction, in such countries as Canada, Cuba, Australia, New Zealand and the various European countries. Somewhat less attention has been given to similar programs in those portions of the world which have more recently been undergoing commercial and industrial development, although almost every considerable country today has taken some steps toward installing this type of telephone equipment.

In the Argentine.

For example, in the Argentine Republic three exchanges of this type, in the cities of La Plata, Rosario and Cordoba, have been in operation for several years. These have proved so satisfactory that the United River Plate Telephone Co., with headquarters at Buenos Aires, and covering practically all of the major cities with local and long distance lines, has commenced the conversion of its 35,000,-line Buenos Aires system to automatic and will make an initial installation of 7,500 lines, designed to operate in harmony with the remaining manual exchanges until the coversion is completed, so that no inconveniences or operating difficulties will result.

This contract is being handled by the International Automatic Telephone Co., Ltd., of London, and the equipment will be manufactured at the Liverpool plant of the Automatic Telephone Manufacturing Co., Ltd., which operates under the Strowger patents of the Automatic Electric Co., Chicago.

In addition to converting the Buenos Aires network, the United River Plate Co. has on order extensions for their Cordoba exchange and for the Iriondo office in the Rosario network.

At Polyglot Dalny.

Another interesting contract on the books of the International Automatic Telephone Co. is an initial 5,000 lines for a 10,000-line exchange to be installed at Dalny (Darien), Manchuria. Some two years ago the Chinese Eastern railway, which controls the utilities in Harbin, the large island center 500 miles north of Dalny, installed a similar telephone equipment there with very satisfactory results.

One of the important reasons for selecting automatic equipment for centers such as these is the very cosmopolitan population found there, with a consequent diversity of language.

In India's Summer Capital.

For the past seven years the department of posts and telegraphs of the Indian government has had experience with automatic telephone systems, having installed a 1,000-line exchange in Simla, the summer capital of the empire, in 1914. The government engineers who decided to adopt this equipment were influenced not only by the fact that the great diversity of language spoken at Simla made manual operation inconvenient and restricted the use of the telephone, but also by the great variation in traffic during the different seasons of the year. While the government is in residence at Simla the use of the telephone is, naturally, very heavy, but at other times the traffic falls to only a fraction of the peak volume.

Shortly after the Simla equipment was placed in service, the department of posts and telegraphs placed an order for a similar installation in Lahore, another northern city. Continuing its program of automatic adoption, a 2,000-line system, 400 equipped, was recently ordered for the city of Poona, some 50 miles inland from Bombay, on the west coast.

Through the Indian posts and telegraphs department, a contract for a 1,600-line (900 equipped) system has been placed for the city of Basra, an important point on the lines of communication between the Persian Gulf and the interior of Mesopotamia, which, as the result of the world war, is now under a British administration.

Still another interesting telephone development is the action of the Shanghai (China) municipal council in ordering a 400-line private exchange to be used in the administration of the foreign section of that city.

Foreign Automatic Prospers.

Just as in this country, telephone manufacturing organizations abroad are busy making up for the war years, during which there was practically no development of the telephone systems. This is especially true of the Automatic Telephone Manufacturing Co., Ltd., which manufactures Strowger type automatic equipment. Although its plant and staff have been substantially increased during the past year, and are now being still further expanded, the output is booked well ahead.

Marconi Busy Abroad with Wireless Telephony.

London, England.—An arrangement was recently come to between the Nederlandsche Seintoestellen Fabriek, a Dutch wireless company in which the Marconi company has a considerable interest, by which, over an experimental period of three months, stock exchange prices were reported by wireless telephony to a large number of banks throughout Holland. The experiment ended a few days ago, having proved completely successful, says the Times.

The British and Dutch governments have granted a license to the Marconi company to experiment with wireless telephony between the two countries. A station for the purpose has been erected in this country, but the station on the Dutch side is not yet constructed.

The Marconi company is also constructing experimental wireless telephone stations to operate between London and Birmingham, and believes that communication can be rendered free from interruption and "tapping," and that the ordinary apparatus used by every telephone subscriber will be able to be utilized to communicate with the local wireless telephone stations, and that connection for the long-distance wireless telephone messages may be thus obtained.

Mexico City-Tampico L. D. Line Under Consideration.

Boston, Mass.—The Mexican T. & T. Co., having its head office in this city, is considering extension of its service from Mexico City, where it has operated an exchange for some time, to Tampico, with a modern exchange at Tampico and long distance lines connecting the cities. Ricardo E. Berg, superintendent of the plant at Mexico City, and Gustave Trevino, superintendent at Monterey, have concluded the investigation upon which the decision will be based.

Wireless Telephone System for South Africa.

The government is experimenting with wireless telephony with the view of linking the chief centers, says the Financial Times. Communication has been successfully established between Johannesburg and Bloemfontein. It is hoped to extend the system gradually, thus lessening the cost of ordinary telegraphic and telephonic working, which is unusually high owing to maintenance charges over immense distances.

OHIO MERGER PLANS.

Congressional Favor of Willis Bill to Result in Hundred Million Dollar Company.

Cleveland, Ohio.—From four to six years' time and employment to the utmost of the resources of a hundred million dollar company, are to be required by the merger of the Ohio Bell Telephone Company and the Ohio State Telephone Company. Some estimate of the time required for the big job set the figure as high as ten years.

Congress passing the Willis bill providing for consolidation of competing telephone companies means bringing the 125,000 Bell and 32,000 Ohio State subscribers in Cleveland under one company, and a realignment of work now being done by 13 Bell and eight Ohio State exchanges.

It is a complicated problem, and one of vast dimensions, that telephone engineers in Ohio face. Eight of the 90 cities in the world which have more than 20,000 telephones are in Ohio, Cleveland, Cincinnati, Columbus, Toledo, Dayton, Akron, Youngstown and Canton. In all these cities but Cincinnati, competition exists.

The board of directors of the new company may comprise: Frank A. Davis, chairman of the board of the Ohio State; C. Y. McVey, president Ohio State; Franz R. Huntington, Columbus banker; John Sherwin, chairman board of directors, Union Trust Co., Cleveland; Shirley Toles of Toles, Hoggsett, Ginn and Morley, Cleveland attorneys; Allard Smith, vice-president, Union Trust Co., Cleveland, and general manager of the old Cleveland Telephone Co., and Edgar S. Bloom, Chicago, president, Ohio Bell Telephone Co.

Property of the Ohio State is valued at about $25,000,000, and the Bell estimate their interests at $75,000,000. The new company plans to organize on a $100,000,000 basis if the state utility commission approves. Cleveland financial circles understand that equal amounts of common and preferred stock will be issued and that the American Telephone & Telegraph Co., which owns the common stock of the present Ohio Bell, will take the common stock of the new corporation.

Mr. Huntington says holders of Ohio State preferred will receive $102 in new preferred, with the possibility that the $2 may be in cash. Holders of Ohio State common will be given an option of $40 a share in preferred of the new company, or cash.

A meeting of Ohio State stockholders to approve the tentative plans and take up details of the proposed merger is to be held soon.

The Ohio State Telephone Company through its toll lines reach every county in the state with the exception of Hamilton county, in which Cincinnati is located. The number of stations owned by the Ohio State Telephone Company is 155,000. The Ohio Bell Company has 301,000.

Cities where competition will be automatically eliminated and a one telephone system inaugurated include Cleveland, Toledo, Findlay, Fostoria, Youngstown, Salem, Canton, Alliance, Massillon, Dayton, London, Washington C. H., Lancaster, Zanesville, Nelsonville, South Charleston, Akron and East Liverpool.

The board of directors of the U. S. Independent Telephone Association held a meeting in Chicago and gave the proposed Willis law careful consideration, unanimously voting to approve the purposes of the bill, believing that some such procedure is desirable for the industry. A committee was appointed by the board to guard the interests of the members of the association in connection with this legislation. This committee: President MacKinnon and Secretary Deering; G. W. Robinson, St. Paul; H. L. Reber, St. Louis; J. B. Earle, Waco.

BATTERY PRICE CUT.

Columbia Dry Batteries of All Types Substantially Reduced —Sales Increase.

Cleveland, O.—An announcement has been made by the National Carbon Company, Inc., of a substantial reduction in price of all standard types of Columbia dry batteries. This reduction in price includes the following brands of dry cells and unit batteries manufactured by the company: Columbia ignitor, Columbia gray label, Columbia red label dry cells, the Columbia hot shot and Columbia multiple unit batteries, and the new Columbia bell ringer battery. The three barrel assortments, consisting of different combinations of Columbia ignitor dry cells, Columbia hot shots, and Columbia bell ringer unit batteries have also been included in the price reduction program. All new prices were effective as of June 1, 1921.

An extensive newspaper advertising campaign is being used by the National Carbon Company, Inc., to inform the public of the lower cost. All dealers have also been supplied with a window poster announcing this fact.

The National Carbon Company, Inc., says this reduction in price has greatly increased the demand for its dry batteries.

TEN SECOND MEN.

Chicago Telephone Men Set a High Moving Record in May Rush.

During April the Chicago organization of the Illinois Bell Telephone Company moved 27,100 telephones. Two-thirds of these moves were completed in the last fifteen days of the month.

In the first half of May, 40,700 orders were completed. This means that in the month of April, in the Chicago district, the telephone company installed, moved or took out four telephones a minute—one every fifteen seconds. During the first half of May this rate was raised to the almost incredible speed of completing an order for telephone service every ten seconds, nine hours a day.

B. E. Sunny, president of the company, who told the Chicago Electric Club of this record, said further:

"In Chicago in 1920 we required about 8,000 operators and we were short of that number throughout the year, from 600 to 1,500. We lost the equivalent of 6,800 operators that we started with at the first of the year out of the 8,000 dropped out of the service. About 4,900, or 60 percent, remained throughout the year, and the losses were largely of operators who remained only one or two months.

"To fill the vacancies we employed and trained 4,250 operators, and we re-employed 3,550 ex-operators who needed little or no training. There were 1,150 additional applicants who passed the examination and started in the school, but who were dropped or who resigned before finishing the training course.

"The year 1920 was perhaps the hardest that we have ever had in securing and holding a competent staff of operators. Since January 1 of this year the situation has changed markedly and favorably.

"As indicating the extreme care exercised to fill the positions with competent operators, you will be interested to know that from January to March inclusive this year we considered 4,600 applications, only 2,000 of which were by persons suitable for the service, or who could pass the necessarily strict examination. Of this number 450 were subsequently sent away because of failure to pass the first medical examination.

"In April there were 67,700,000 local calls, and our observations indicated that 96 percent were answered within ten second, and 96 percent of the connections that could be completed were completed without error. Ten million calls failed because of the busy signal; 75 percent are party lines, etc.

Rochester Combine Gets O.K.

Independents Buy Bell's Properties in Kodak City and Adjacent Points, Upon Receiving Commission Approval

Rochester, N. Y.—The New York Public Service Commission has authorized the Rochester Telephone Corp. to take over and consolidate the physical properties of the Rochester Telephone Company and the New York Telephone Company in Rochester and vicinity. The order effects about 60,000 subscribers, of which 45,000 are in Rochester.

The actual consolidation as it affects subscribers will be accomplished by Aug. 1st.

The commission also granted a certificate of convenience and necessity, and authorized the issuing of approximately $8,000.000 of securities to perfect the consolidation.

Planned for Years.

The first announcement of the plan to form a company to take over the Rochester and the New York companies was made on Jan. 17, 1918, and the application to the Public Service Commission for the order just granted was filed on Aug. 6, 1920.

The work of providing the central office and outside plant facilities necessary to combine the existing systems in Rochester has been going on for some time and little remains to be done to furnish the unified service. All the central offices of both companies in Rochester will be continued.

Geo. R. Fuller, president of the corporation, said that the rates for the unified service would be filed with the commission immediately.

Extent of Double System.

The new corporation will take over and operate, in addition to the six central offices in Rochester, thirty-five central office district as follows:

Atlanta, Avon, Bergen, Brockport, Caledonia, Canandaigua, Castile, Charlotte, Churchville, Fairport, Gainsville, East Rochester, Fairport, Gainsville, Geneseo, Hemlock, Henrietta, Honeoye Falls, Leicester, Le Roy, Lima, Livonia, Manitou, Mt. Morris, Naples, Nunda, Pittsford, Rush, Scottsville, Springwater, Victor, Warsaw, Wayland, Webster and Wyoming.

In the district to be served by the corporation four communities are now served by the two telephone companies. They are Rochester, Bergen, Brockport and Canandaigua. The remaining thirty-two places mentioned above now have a single telephone system, consolidation where two systems previously existed having been brought about by the New York Telephone Company in the last two or three years.

Officers and Directors.

The Rochester Telephone Corporation will be under the supervision of the Rochester people now controlling the Rochester Telephone Company. George R. Fuller, president of the Rochester Telephone Company, is to be president of the new corporation; Fred C. Goodwin of Rochester, vice-president; Thos. J. Hargrave of Rochester, secretary; Frank J. Brookman of Rochester, general auditor; Charles M. Beattie of Rochester, general treasurer.

The board of directors consists of the following: George R. Fuller, Fred C. Goodwin, W. Roy McCanne, Frederick W. Zoller, J. Foster Warner, John Craig Powers, Carl F. Lomb, Thomas E. Lannin, Frank T. Sage and T. Carl Nixon, all residents of Rochester, and Tage P. Sylvan, of Montclair, N. J.; Hiram F. Stevens of Greenwich, Conn.; Charles A. Spaulding and Peter O. Jacobs of Buffalo, and William B. Woodbury of Columbus, Ohio, representing the New York Telephone Company.

All the officers are Rochester men, most of whom have been connected with the local telephone company for a number of years, and that two-thirds of the board of directors are Rochester men, the others being representatives of the New York Telephone Company.

The executive committee consists of Messrs. Fuller, Goodwin, McCanne, Woodbury and Sylvan, three out of the five being Rochester men.

Operating Organization.

In addition to the president, vice-president, secretary, treasurer and auditor, the operating organization of the Rochester Telephone Corporation will be as follows: William J. O'Hea, assistant to the present; John W. Morrison, general plant superintendent; Charles G. Vickery, general superintendent of traffic; William T. Farrell, general commercial superintendent; Benjamin F. Gibson, local commercial manager.

Other executives and employes of the two telephone companies both in Rochester and in the outside territory will be continued in their present positions by the Rochester Telephone Corporation. The new company's employes will number about 1,200.

Demand for Single System.

President Fuller says: "The desire for a single telephone system locally controlled and locally managed in Rochester has been made manifest through the public press and in many other ways. Leading business and professional men and others in many walks of life have decried the economic waste resulting from two separate services. The abolition of this waste is about to become an accomplished fact. The Rochester Telephone Corporation, controlled and managed by Rochester men, has acquired the holdings of both companies operating here and is now putting a single telephone system into operation."

All activities of the new system will be directed from Rochester. Rochester is to become the banking center for all the revenue of the telephone corporation and its income will be largely distributed in Rochester. The Bell division office for this district has been in Buffalo; the main office, in New York City. Complete accounting offices of the new corporation will be in Rochester.

Vermont Organizes Phone Men's Association.

Morrisville, Vt.—On June 18 a permanent organization of the state's telephone men is to be effected here. Temporary officers of the organization are: C. D. Cushing, Bethel, president; C. L. Spear, West Corinth, vice-president; C. L. Ovitt, Enosburg Falls, secretary-treasurer; F. Harding Chesmore, Jonesville, auditor.

Ashtabula, Ohio, Accepts New Franchise—To Build.

Ashtabula, O.—The Ashtabula Telephone Service Company has given formal notification to the city council of its acceptance of the new 20-year franchise. The company will immediately take steps toward construction of a new block to cost $150,000. Upon completion of the new building and installation of new equipment, the company may make a material raise in rates, it is said.

Touring New York's System

Methods of the Great Plant Described in Brief to National Association of Corporation Training Members During a N. Y. Plant Inspection Trip

An epitome of the methods of a great plant, as well as a model for conducting an inspection tour of a telephone company's facilities, is represented by the digest of remarks made by New York telephone men made during an inspection of the plant by members of the New York Chapter of the National Association of Corporation Training.

Picked Force the Key.

Dr. L. F. Fuld, of Henry L. Doherty & Co., a nationally known vocational authority, gave the keynote of the company's success in his brief talk at the beginning of the tour. Dr. Fuld said: "There is one utility which seems to have fewer enemies than the others, and in normal times that utility can even boast a few friends. And when we analyze that condition (and I am referring to the telephone industry, as you know), we personnel men believe that it is due largely to the manner in which this utility selects and trains and manages its personnel."

New York Executives Meet in Phone Lunch Room.

H. W. Casler, assistant to vice president, outlined the line of march, and invited the visitors to the regulation operator's luncheon, where there was staged a pleasant demonstration of the manner in which the New York Tele-Phone Co. makes use of dietetic wisdom in promoting operating efficiency. Mr. Casler referred to the plant inspection as a means of making friends, as follows: "I am sure that at the end of this day every one of you, if you have been unfriendly, are going to be our warm friends. We have had chronic kickers come into our plant in the past and after an inspection of our plant and of some of our problems have gone away the best and warmest of friends. Moreover, many of these have become 'rooters' for the telephone company."

Employment Problems.

E. G. Anderson, employment manager, traffic department, told the guests: "The problems that we have had to face during the past few years have probably not been different from the problems that have confronted all of you, or most of you, at least. There was, of course, the competition of other employers which resulted in an increased turnover, and we had also a tremendous expansion in the business which made it necessary to still further augment our forces, and in order to get the increased forces that we required, necessarily, we lowered somewhat our selection standards, and in lowering our standards, why, we of course again affected the turnover. As the turnover increased and as the demands for additional people increased because of the increase in business, we still further lowered the selection standards, which again increased the turnover, and so seemed to work in a circle, which, I think, has been the experience of others, also, for several years.

"Our sole motive for being in business is to deliver telephone service, and everything was sacrificed in order to obtain telephone operators to render the service during this trying period. We had the very best of co-operation within our company during this period. All of the departments subordinated their needs to our needs in order to make it possible for us to get the largest number of people in the shortest time.

"To give you some idea of the growth of the past couple of years, we started two years ago in January with a total operating force (chief operators, supervisors and telephone operators), in the greater city, of 8,400 people, and at the present time we have something over 16,000. Our problem is not represented alone by this net increase, but also by an increased turnover in the meantime. In normal times the average life of a telephone operator has been about 42 months. That was so far reduced so that in 1920 the average life of the telephone operator as determined from the turnover dropped to very nearly 18 months. In normal times we accepted about one girl out of every ten that applied. During 1920 we accepted as high as 45 out of every 100. As you can see, if 10 out of 100 in normal times gave us the quality and the quantity that we required, and we had to take 45 out of every 100 during 1920, necessarily we could not make the same selection that we could when the labor market was a little bit easier.

"There has been a very marked change in the labor market within the past few months. In the early part of the year, I think we accepted 47 of every 100; that dropped in 21 in November and 15 in December and January, and was down to 10 in February. We are practically back to normal in that respect.

"The applications increased tremendously. In 1919, for example, we interviewed 22,000 girls and in 1920 we interviewed 59,000 girls, so that not only was the percentage of acceptance very high, but it was applied to a very large number of applicants. In normal times we could count on 95 out of 100 girls we accepted actually reporting for duty in from one to ten days later. That dropped as low as 70 during the last year, i.e., out of every 100 acceptances, when the time to report came around only 70 would report for duty. Ordinarily we graduate about 80 out of every 100 girls, but because of the difference in the caliber of the girls that we accepted during the past year, that dropped to about 65 out of 100. Necessarily there was a great deal of waste, but we were after numbers. A girl who could sit at a switchboard and handle even 25 percent of a load was better than no girl at all, and we used to say to ourselves, 'Anything in skirts looked good to us,' last year.

"Then we had also the man problem. For a number of years we had taken each year a number of young men right out of college, and our normal requirements in the traffic department have been 12 to 15. That is the rate at which we have been able to absorb them. For three or four years we have not been able to get these men, because the men we were after were eligible for military service and, of course, not available for us. Last year we started a special drive for them, canvassing most of the schools in the east. I think we interviewed 300 men and offered jobs to half of them, which, of course, is a very much higher ratio than in normal times. Out of the 150 only 100 men accepted and reported for duty, and I think we have about 80 of these men left after an average period of service of about six months. We have noticed an easing up on the labor market, in that we have a great many applicants — voluntary applicants now. Last year we had to go out and almost drag them in.

"Our employment department of the traffice department of this company is not as completely organized as it is in some other industries. It is a relatively new idea with us, established very suddenly and hurriedly during the war period in order to take care of an emergency. We are not the hiring and training and firing department as it is in some corporations. We do the employing. The training is a separate function, although it is centralized. The continuation training, as we might call it, after a girl completes her preliminary course, is also centralized, but is a still separate function. The dropping or the firing, as it is sometimes referred to, is not yet centralized, although we have recently centralized the interviewing of all girls who indicate their intention of leaving the service voluntarily. We have found that that has been well worth while. The motive back of it, of course, is the assumption that perhaps the resignation in some cases is based upon a grievance, either real or fancied, which can be adjusted, and our experience has shown that this is so. We have not yet reached the point where the interviewing of employes to be fired is centralized, but that is a step that we may come to later.

"We have not yet centralized the employment for the entire company, but I am glad to say that this is another matter under consideration at the present time. The failure to have such centralization in one department finds us, of course, in the position of laying off employes in one department and hiring exactly the same kind of employes in another department."

WHAT NEW YORK'S MOTOR FLEET MEANS IN MONEY.

Value of garage shop and equipment, L. I. City	$ 312,879.61
1,100,000 gal. of gasoline used in a year	330,000.00
Tire bill for one year's operations	160,000.00
Repairs on all cars (approximately)	600,000.00
Total cost of operating 1,010 cars one year	1,366,200.00

The Mosquito Fleet.

Miles covered by 670 Ford runabouts in yr.	7,000,000
500,000 gal. gasoline consumed at 30c per gal.	$150,000.00
Cost of 5,376 flivver tires changed in year	80,000.00
Total Ford expense	910,000.00

—Telephone Review.

Central Office Administration.

D. D. Field, employment supervisor, traffic department, gave an insight into the traffic department organization which is built up under a general traffic manager. Mr. Field said of this work:

"It is departmentalized into divisions which are further divided into districts, the divisions being headed by division superintendents of traffic and the districts by district traffic managers. Each district traffic manager has charge of two, three or more offices, depending on the size of the units involved and their geographical location. The actual head of the operating forces in various central offices is the chief operator, and to her report the various sub-officers, such as the assistant chief operators, supervisors, instructors, etc. The clerical details of central office work are also in charge of the chief operator.

"The operation of all of our units is conducted along lines and practices developed by careful study both from the point of view of experience and experiment on the part of our departments of traffic supervision, engineering, etc. Every detail of our operation is carried out along lines in which our operators are definitely and carefully instructed and according to approved practices which they are expected to follow in detail.

"In all of the operations, training and careful, diligent supervision go hand in hand.

"The spirit that dominates the work of all the central office employes is to endeavor to give good service for the sake of good service, and to operate properly, and to do good work not because they fear that they mal lose their positions if they do not, but because that is the proper thing to do and the only way they can put the company for which they work before the public in a light in which they will be proud to see it."

Training Operators.

Miss K. M. Schmitt, school manager, operators' training department, reviewed her department's activities: "The training course extends over a period of three or four weeks, this time being divided between classroom instruction and switchboard practice. The classroom instruction is arranged in a series of lessons, each lesson presenting a certain phase of the work. The switchboard practice is arranged to give actual practice to each classroom presentation.

"When a student enters the training department she immediately becomes part of the organization and is paid a salary as an employe. She is at first assigned to a class and remains with that class in charge of the same supervisor during her entire training period.

"In presenting the lesson to our students a development plan is used which we find brings good results. According to this plan a class supervisor presents a lesson in a series of well prepared questions, assisted by a demonstration switchboard. The students are led step by step until they become familiar with the various operations, seemingly with but little instruction. This method creates interest and develops mental alertness.

"After a presentation the classroom supervisor takes her students to the switchboard, where they are given an opportunity to work out the various operations previously explained in the classroom.

"A card is kept of each student on which is noted her daily progress, with such other information as may be of assistance in her training. By means of these cards and by personal observation

a classroom instructor is kept very closely in touch with her students.

"Throughout the training courses considerable time is given to voice expression and trying to make the student realize its importance. We try to make her see that the subscriber cannot observe her work but must form an impression of its character from her general manner as indicated by her voice. Also that the subscriber, finding the operator pleasant and apparently anxious to give him attention, meets her in the same way, thereby establishing a feeling of mutual good will."

Safety First.

J. F. Naylon, division equipment superintendent, covered the company's safety work by saying:

"I do not feel that there is any place in telephone work for the use of the term 'Safety First.' Our slogan or motto, call it what you may, has always been 'Service First.' If we can give service first with safety, we give it; if not, we give it without safety.

"Imagine a gang of linemen after a heavy sleet storm, with poles, wires and crossarms covered with ice, thinking of safety first when it is their job to restore the service, whether it is safe to do it or not.

"We are, however, very much concerned with accident prevention work. We are trying to do a little bit of missionary work among our people to get away from the expression 'Safety First.' It is becoming more or less hackneyed; it has lost considerable of its force during the past few years, and we feel 'accident prevention' are two better words to use in connection with safety first, particularly with our business. Nearly twenty years ago the New York Telephone Co., as well as other companies associated with our system, realized that there was room for improvement as far as the safety of employes was concerned.

"Apparently the most fertile field for us in bringing about a reduction in the number of accidents we had was the education of the various employes to be careful and thoughtful of their own safety and the safety of their fellow employe on the various jobs.

"It was finally decided that in order to get quick results the best thing we could do would be to build up a series of illustrated talks, showing how accidents had happened, how others might happen, and how many of them might be avoided. These talks were productive of a great deal of good, but they were not the final word, because in order to get permanent results we could have to do something more constructive. The next step we took was the formation of various accident prevention committees to review accident reports when there are such, prepare bulletins and literature for the educational field, hold conferences and generally supervise the work, review conditions and practices that might cause an accident, and solicit suggestions. There is one common secretary for all of these committee to tie them more closely together.

"We have given a great deal of attention to the development of tools that might possibly avoid introducing additional hazards in the business.

"The one feature of our work that has enabled us to make the best showing is probably the one where we introduced a little sporting element in the work by stimulating among the men a spirit of competition.

"Perhaps the most spectacular experience we have had was with one of the divisions of the committee. During 1917 and 1918 this particular division of the committee had been particuladly hard driven, with the result that the accident prevention work of that particular division went by the board. They had a terrible record in 1917 which got worse in 1918, and the first month of 1919 indicated that it was going to be worse than ever in that year. Pressure was brought on the various working forces, and the result was that beginning almost on the stroke of twelve on the night of January 31, 1919, the particular division did not have a lost time accident for 65 consecutive days with a force of 1750-odd men.

"The educational work that we have undertaken and have continued was simplified to a great degree by reason of the fact that throughout the business we have a particularly high grade of employes. On the other hand, our work is somewhat complicated by the fact that our employes are distributed over wide areas.

"In addition to the work I have already described, we are now trying out an experiment in one of these committees, in which we are giving a large number of men an intensive course of training in first aid to the injured. It was put on a purely voluntary basis, and very much to our surprise we counted about 50 percent more volunteers than we expected. The work is hard and trying; it takes a great deal of time, but it has been so interesting that everybody has stuck to the job.

"The net result of our work along accident prevention lines is that we have been able to reduce our lost time accidents from 9.97 per hundred employes in 1916 to 6.33 per hundred in 1920.

"In one division of the company a reduction from 13 per hundred employes in 1918 to 2.8 per hundred in 1920 has been accomplished.

"An increased efficiency that is difficult to evaluate in money has been obtained through our accident prevention work, for we believe that the employe who is more careful and thoughtful of his safety will make a better splice, do a better installation job, a better repair job, and a better job all along the line."

The Telephone Review.

W. F. Schmidt, division supervisor of publicity, said about the company's house organ:

"The circulation of the Telephone Review includes the exchanges and copies sent to associated companies, so that in round figures about 50,000 copies are printed for each issue. It is the purpose of the Telephone Review to gather our telephone family around the reading table and bring the industry home to not only our own employes but to the brothers and sisters and parents and families and friends and associates of all those who are engaged in the telephone industry.

"We have a Telephone Review editor, an assistant editor and one copy writer. In addition to this, the force is aided by the publicity department. Furthermore, in the downstate division, we send our searchers out constantly looking for material. In the upstate divisions we have divisional committees who gather and cull the material which is forwarded."

Employe Representation.

P. D. Honeyman, division plant superintendent, outlined the employe's part in the company's work. He said:

"The employes below the grade of foreman in the plant department and corresponding positions in the other departments are organized into voter employe groups. The voter employes are divided into councils, as far as possible according to occupation. The councils elect their representatives by secret ballot. Those representatives are formed into council committees. The plant department, comprising about 1700 employes in the Long Island division, has one representative for about every 50 to 60 employes, a total of 33 representatives. There is a divisional committee elected, one member from each of the employe representative committees, to which can be referred matters that are common to all councils. Any matters that cannot be settled in the joint meetings can be referred through the lines of company organization to the highest authority in the company.

The plan allows any subject whatever to be brought up for discussion and settlement in joint meeting with a corre-

sponding management committee. We have a monthly meeting of these representative committees, followed by a joint meeting with the management committees to discuss and settle any questions that may arise.

"Our plan of representation started during the strenuous war period, when the cost of living was soaring by leaps and bounds and when the relations between employer and employe were strained perhaps as they never had been before, and naturally there was a great deal of suspicion when we first started. One question at the first meeting we held was: 'Does the company expect to benefit by this plan?' It was a very good thing for the management that this question was asked. The answer was: 'Yes, we do; we expect to profit by it, but we expect the employes to profit fully as much as the management, and, in fact, the management can profit only through the profit of the employes.'

"Following along the line of progress of the plan, the first matters brought up were what you might call grievances, the employe representatives really becoming grievance committees. But our theory and practice worked admirably; with all the facts known, with these men round the table, trouble faded away.

"One important feature of the plan was to appoint very careful secretaryship, whereby the minutes of the conferences were carefully recorded, and a digest is published periodically and given to every voter employe. In that way the voter employe has more confidence; he knows what his representative is doing, and at the same time many constructive thoughts that have been brought out are sent further down the line. I can say with absolute assurance that the plan of employe representation has more than been repaid in the brief time it has been in existence, in increased production through greater satisfaction and interest in their work on the part of the force."

Plant Department Schools.

J. G. Lowden, repair supervisor, spoke as follows on the educational system of the plant department:

"In the past we used what is known as the helper system, that is, when a new man was engaged he was sent out in the department for which he was employed as a helper and stayed with an experienced man for a period of six months or longer. The basis of all our training now is the new man doing all of the work himself, but under close supervision.

"Let us take a new installer and follow him through the school course. When he is engaged he is sent directly to the school. The purpose of this school is to give him a knowledge of elementary electricity and elementary telephone work. The first thing we give him in that school is a talk on the company's policy, what the company is, the benefit plan, the employes' representation plan, safety first, and all general ideas. We also tell him how to behave in public, as to his personal appearance, etc. The next thing we do is to give him some experiments with the magnet and other electrical appliances of that sort, and a general knowledge of the fundamental circuit, the desk stand circuit, which is the one used generally in our business. This course takes one week.

After finishing that course he is sent out with an experienced man to help that man for one week. The purpose of this part of the education is to give him a picture of what our telephone plant looks like outside, what the cables are, what the wires are, what the terminals are, the relation of one to another, how to call the office and get work; to report work completed and report time and material. While he is doing this we have arranged things so that the experienced man is giving the new man daily, in very simple terms, some new phase of our work.

"As soon as he has completed that week he goes back to school, where he is given a more detailed course in the desk stand telephone circuit. The purpose of this part of the schooling is to tell him in detail the circuit of the desk stand telephone, the operation of the various pieces of apparatus, and how to make tests on the telephone. This is given by means of practical work on demonstration sets, which are telephones with the outer shell cut away and the inside part exposed. We teach in this grade the fundamental principles of an induction coil, of a condenser, of our bell and the talking circuit. Lectures illustrated by lantern slides are also given.

"He is now sent to a special school where he is taught how to install telephones. Inside of one of our buildings we have built another building. In the building is a back yard with a fence with cables and terminals on it, also a brick wall with a window and a door. We also have a wooden building with a window, cellar and upstairs (both on the same floor) and an office—almost everything you can find in telephone work—and it is in this building that the new man installs his first line. He installs one as he thinks it ought to be installed. Then he uses the different types of construction and installation, and when each line is finished the entire class stops for a minute and all go over the line and are shown all the defects. When he finishes in this school he is ready to go out alone to install telephones.

"The employe also learns in this school how to drill holes in brick, how to drill holes through window casings, how to place wires in moulding, and how to run wires around the walls. We have a set of sample walls. These walls are plastered on one side, but on the other side the material of which the wall is made is exposed. There are several classes of construction shown. For example, hollow tile, wood lath, metal lath, plaster board and others. All walls look alike from the front and the employe is taught to distinguish the walls by sounding. This is in order that he may know the type of wall to which he is fastening telephones when he goes out alone and may secure the telephone with the proper type of material for that particular type of construction. This schooling lasts one week and has proven to be of great value.

"He is now sent out under a foreman, five men to a foreman, and this foreman goes over every detail of each job that they do. In order that they may obtain the maximum training, the men are brought back to the school for four hours a week (for a whole afternoon), and in the school at that time they go over the different conditions which the five men have run up against that week, and an explanation is then made to all of them.

"From this work they go on switchboard work and other more complicated work. At this point the foreman makes a report of each man, tells us what the man has done, what he is like, in what department he should be put. It is from these trained installers, after five or six months of training, that we take our repair men.

"These repair men receive constant training. The work of the repair force is of an analytical nature; the work of the installation force is of a constructive nature. There are two different lines. Men who show analytical ability are transferred to the repair force. The study of the switchboard circuits is also a school course.

"From the installation and repair forces (men who have been trained and have worked up) we take the men for the wire chief's force to be developed in the more complicated side of our work. We also hire men direct for the wire chief's force. These men are assigned to night work and develop on night work. When they are transferred to day work they have had the same education as the installers and repair men.

"There is also the construction end of our work. The new man hired for

this duty is known as the splicer's helper and receives a course of training of one week in school and is then sent out to help the splicer in his work. One of his primary duties, however, is to protect the splicer who is working down in the manhole. He heats the solder and arranges all of the material on the street and lowers that material to the splicer as he needs it. The splicers receive a course of instruction covering about six weeks in school, with both practical and theoretical work, before making any splices on the job."

Traffic Department Personnel Work.

Miss M. D. Spencer, supervisor of employment, traffic department, told of the company's convalescent home for its girls at Warwick, N. Y., on May 1. She said:

"We have more than 350 acres of ground there and hope some day to open a girls' camp.

"We thought for some time that our chief operators in the central offices were able to look after the welfare of their people and manage the big job of giving telephone service at the same time. We have been finding out, however, that it is hardly possible for them to do so without some additional help; so recently we have appointed personnel assistants who are assistants to the chief operators, to look after the welfare of the girls in her building, to see that the quarters are kept in good condition, keep in touch with dining room conditions, and make it easy for the girls to avail themselves of all the personnel activities which the company affords. In selecting people for this work we have tried to use our own employes and have done so with two or three exceptions.

"We have given them a course of training which included inspection tours to other organizations, weekly conferences, etc."

Labor Statistics.

Robb Carson, supervisor of labor statistics, told about labor statistics, saying:

"In our labor turnover reports, compiled on a regular monthly basis, we show resignations, dismissals and other losses by specific causes. For general executive purposes this information is presented by departments and divisions. For each department and departmental division we compile the same information by occupational classes.

"Throughout our labor statistics a separation is maintained between males and females. We also furnish in each report a comparison between the current period and the corresponding period of the preceding year. An additional feature of some interest is the analysis of total losses by rates of pay and periods of service, respectively, which items we have incorporated as integral features of our labor turnover reports.

"Our primary statistical tabulation on wages is compiled quarterly and is designed to show, separately by departments and departmental divisions, and for each occupation class (1) number of employes; (2) average rate of pay; (3) average period of service. As in the case of our labor turnover statistics, a separation has been maintained throughout between males and females and a comparison furnished with the corresponding period of the previous year.

"Our problem is (1) to assemble the primary data affecting a force of some 50,000 employes scattered throughout the extensive territory of our operations; (2) to accomplish this without burdening the operating department.

"As to wage statistics by coding on the payroll itself (a) the sex of the employe, (b) occupational class, (c) date of engagement.

"The rate of pay being the primary feature, we are able, having established this supplemental data on the payroll, to compile any statistics which may be required on wages associated with occupational classification and period of service, without calling upon the field for any information whatever.

"All payrolls for our entire territory are made up at one central point, although the weekly payment of salaries and wages involves the physical distribution of moneys at well over one thousand points."

Medical Department.

E. S. McSweeny, M. D., medical director, said:

"Employes visit our medical department entirely by appointment. Each one brings an appointment card, which is a card of introduction from his immediate superior to the doctor.

"When they come into the department office on their first visit, statistical information has to be noted at the head of the card, and also the information which the nurse finds saves the doctor's time—if there were any previous illnesses, etc. This is done in a room where there is nobody but the nurse and the patient. The employe is brought to the doctor by the nurse and is personally introduced—'Dr. R—, this is Miss Jones'—and when the doctor is through with the employe he presses a button and the nurse comes again to the door and the doctor says, 'I want Miss Jones to see the dentist,' or 'I want Miss Jones to come back on such a date.'. The employes feel that there is a very strong personal touch in the whole thing. It takes a little more time, but is worth while; at least we think so.

"The second thing to which I want to call your attention is the fact that we give no continuing treatment, either medical or dental. We do a very large amount of first aid work, both medical and surgical; not only cuts, scratches, bruises, burns, etc., but sore throat, headaches, cramps, indigestion, etc. What we give is very complete diagnostic service and advice on these lines. These things we feel are often omitted by reason of the patient lacking the funds, or the hesitancy of their own physician to advise them, knowing that it will be an embarrassment to pay the bill.

"Anyone who is under the care of a private physician and he advises that they need a series of pictures taken, we are glad to take them and return the result of our X-ray and the plates to the physician and to give all the information which we can possibly collect. The same applies to laboratory work of all kinds.

"Accidents occuring in the course of a year do not result in one-tenth as much disability and time lost as do the so-called preventive medical cases. In our organization, and it is true in practically all others, about one-third of the total absence is due to the minor respiratory illnesses, such as colds, laryngitis and tonsilitis, and there is where we are laying our chief emphasis.

"We do not have the number of tuberculosis cases at the present time that we had two years ago, because we pick up people who do not feel as well as they should, perhaps look a little bit pale; who are beginning to be absent a little more than the average number of days of absence; who are complaining of being tired; and who when we make our annual re-examinations have lost some weight since the year previous. We go intensively after these cases and make an effort to find out definitely what is the matter with them and to do something about it then.

"We send these cases, largely, to our rest home. We have acquired at Warwick, N. Y., 400 acres where we hope to open a rest home truly our own, and we intend to enlarge this work very considerably. We get these people, especially these young women, send them out there from one to three or four months, and our experience has been most gratifying. We have at present back on the job working for us approximately 150 girls who have had this experience and have been back and have kept well for over one year."

Benefit Plan.

J. S. Kennedy, secretary of the employes' benefit fund committee, outlined this organization's achievements:

"Nearly 156,000 men and women who

are now giving their best years to the telephone service of the country will henceforth be assured of assistance in the exigencies of life, for which not all are able to provide, and will also be assured of a provision for their declining years.

"The intent and purpose of the employer in establishing a plan of benefits is to give tangible expression to the reciprocity which means faithful and loyal service on the part of the employe, with protection from all the ordinary misfortunes to which he is liable.

"For the purpose of carrying out this plan in the Bell system there has been set aside in the United States the sum of $9,219,143, of which $3,000,000 is from the eastern group of companies, the New York company's proportion being $2,000,000. These amounts were deducted from the surplus of the companies and stand as reserves. This amount, with interest at 4 percent per annum, computed semi-annually, is set aside to pay the benefits and pensions, and any deficit is made up by charges to operating account, so that the integrity of the fund is always maintained.

"Class A covers employes whose term of employment has been twenty years or more. The youngest age of retirement for male employes is 60 and for females 55. An employe may retire at his own request if he so desires. Class B covers employes who have served 25 years or more, whose age of retirement is 50 to 54 for females and 55 to 59 for males. Class C is for those who have been in the service thirty years, no matter what the age is upon retiring.

"The plan makes provision for taking the average annual pay for ten years in determining the amount representative of the pay of the employe which shall be used in computing the pension. Such 10-year period shall be either the last 10-year period or, in the discretion of the committee, it may be the ten consecutive years during which the employe received the highest wages. This arrangement is valuable in the case of an employe who, on account of his age, may have been retained in active employment at a wage lower than he formerly received. An employe as he grows older can accept less arduous duties with lessening pay without thereby being deprived of a pension based upon his best ten years' record. An employe who had 15 years of service would be given a disability pension if totally disabled by reason of sickness from carrying on his duties.

"The Bell plan is more liberal than payments under any workmen's compensation law yet enacted.

"Our experience has been that 98 percent of all accident cases have resulted in disability for a period of thirteen weeks or less. We pay 100 percent for the first thirteen weeks and 50 percent thereafter. In cases of sickness, where the term of employment is ten years or more, we pay 13 full weeks' and 39 half weeks' salary. For employes whose term of employment has been five years or more but less than ten years, full pay for 13 weeks is given, with half pay 13 weeks. Employes who have been two years in the service but less than five receive four weeks' full pay and half pay for nine weeks. Employes in the service one to two years receive two weeks' full pay and four weeks' half pay, and those in the service less than one year get one week's full pay and two weeks' half pay. These payments, of course, are the usual ones, but the benefit fund committee has authority to relieve cases of distress or destitution beyond the provisions of the plan, and is constantly giving special consideration to such cases.

"Then there are the death benefits payable to a wife or a husband or dependents. For ten years or more of service, one year's pay is granted, not to exceed $2,000. If an employe's term of employment has been five years or more, but less than ten years, the benefit is sixth months' pay, not to exceed $2,000, payable to the dependent relatives, wife or minor children, without question. If an employe meets with death by accident, we pay under the workmen's compensation law.

"Since this plan has been put in existence, in 1913, we have paid $3,717,221 in benefits.

"One of the potent reasons for the success of our plan has been the high class of men who have served on the benefit fund committee.

"The plan has been set up for the employes without any cost or assessments of any kind to them."

The Telephone Society.

A digest of the remarks of E. H. Dyer, president of the Telephone Society, Inc., follows:

"Nearly twenty years ago the Telephone Society was started. It originated with a small group of employes of the company who had a desire to get more instruction, to become more intimately acquainted with the business. About five years ago there sprang up a desire for athletics. A Telephone Club was organized at that time, and a clubhouse leased at 353 West 17th street with club and recreational facilities, track, gymnasium, billiard and pool tables, lounging rooms, bowling alleys, a large assembly hall, etc. The club flourished along athletic lines, and at the same time the society was pursuing its educational function.

"Then the war came and of course both the club and the society ceased largely their activities. At the conclusion of the war the two merged together under the Telephone Society and the membership as a result was largely increased.

"The society membership is limited entirely to male employes, but the clubhouse is used for what we term departmental functions, which are attended by employes of both sexes. Social activities of the various departments are encouraged very largely.

"We have now in Long Island 1,374 members, in New Jersey 1,277 members, in Westchester 437. These together with the main society membership of 3,800 make a total membership of very nearly 7,000.

"Briefly, the function of the society has been to provide a convenient, clean, well conducted, attractive place for employes of the company to get together at their social affairs. That particular point is stressed. It also furnished for them a convenient place to carry on their athletic activities."

System and Spirit.

T. P. Sylvan, vice president, concluded the tour with some pertinent comments on the Bell system and the spirit of its employes, stressing service as the foremost motive of the system's employes, telling of the research work the company is doing to increase the telephone's benefits to the nation. The esprit de corps of the "Bell Family" he revealed by some typical examples.

Bloomfield's Bogey Men Try New Exchange Scare.

Bloomfield, Neb.—It has been about two months since Bloomfield went on a telephone strike. The Nebraska State Railway Commission and the local telephone company are standing pat on the increased rate schedule recently approved after due examination by the state authorities. In view of this firmness some of the populace have spoken of starting a new company. With the rates proposed for the planned enterprise, the worst the present telephone company can with its potential competitors seems to be that the present plans are carried through.

Federal Anti-Boycott Action Looms at Angola, Ind.

Angola, Ind.—The Indiana Telephone Association has entered the lists in the boycott being conducted against the Steuben County Telephone Company, on account of increased rates. Federal law will be invoked if warranted.

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FORCE GOES ON STRIKE.

Litchfield, Ill. Couldn't Meet Labor Market Prices on Low Rates.

Litchfield, Ill.—This town is undergoing what the movie directors call a "throw-back." It is back to the days before the telephone for the telephone company's force is on a strike and at this writing there is no prospect of service being restored.

The situation has been developing for some time, and despite the heroic efforts of B. M. Burke, president of the Litchfield Telephone Company, came to a crisis in May.

Mr. Burke outlines the situation:

"The Litchfield Teelphone Company has had a serious time for the last four years keeping operators. It could not break them in fast enough. There are other industries using girls and women that, we are told, pay more than we were paying—at any rate our operators left us to go to them. We were paying local operators $48 per month during a part of this period. We had to import operators that cost us $75 to $80 per month in order to operate.

"October 1 last we raised the operators to $60 per month and made other increases made necessary by conditions. The total increase in salaries was $9,672 per year. October 5, 1920, we made application to the State Public Utilities Commission for an increase that would cover this increase in salaries only.

"They granted an increase that only covered half of this amount. We found that they had misinterpreted the figures on the salaries and applied for a rehearing which was granted.

"At this hearing it was shown that these figures did not represent the increase being paid. Another hearing was had and nothing was done to grant relief. At this last hearing a committee from the city was present objecting to an increase but no evidence was presented at any of the hearings by the citizens.

"The company during the period from Oct. 1 to May 1 had borrowed $3,200 to pay operating expenses.

"April 30 a notice was posted stating that owing to the fact that no relief had been granted by the commission the company was borrowing money to pay salaries, they would, if they continued to operate, have to reduce salaries to what they were Oct. 1, 1920.

"May 1 the entire force walked out and have been out ever since with no chance, that we can see, of a resumption of service at existing rates.

"The company cannot borrow money indefinitely because this would soon mean bankruptcy and the employes will not give in, claiming that they cannot live on the old salaries."

D. S. Parker, California Phone President, Dies.

D. S. Parker, manager of the Pomona Valley T. & T. Union since its inception in 1903 died recently at Pomona, Calif. Pneumonia contracted after an operation was the cause of the death.

Mr. Parker was elected president of the California Telephone Association a week before his death. He had served as a director of the national telephone association. Mr. Parker was a credit to the industry that counted him among its leading figures. An indication of his standing locally comes in the form of lengthy newspaper dispatches telling of the invaluable service he wrought as a community builder.

A few weeks previous to his death Mr. Parker suffered the loss of his wife by death. The shock was a strong factor in hastening his end.

LaGrande, Ore., to Have a Grand New Office.

LaGrande, Ore.—The Home Independent Telephone Company is to move into one of the finest central offices of its size in the country Nov. 1, according to company officials. More than $25,000 is being spent in equipping the office. About $70,000 will be spent on construction work bringing the entire plant up to the standard of the new exchange.

Lake Preston, S. D., System in Ambitious Move.

Lake Preston, S. D.—With the ambition to make the Lake Preston telephone system the model for plants of its size, the local telephone company is adding considerable new equipment and extending its lines. Citizens, according to newspaper reports, are taking a justifiable pride in the Lake Preston plant.

Bell-Independent Merger at Canton, Ill.

Canton, Ill.—Officials of the local independent system and the Bell Telephone Company have signed a long pending agreement for merger of the two systems locally under the management of the independent interests.

Indiana Bell Approves of $2,300,000 New Work.

Indianapolis, Ind.—The board of directors of the Indiana Bell Telephone Company have approved plans embracing the expenditure of $2,300,000 for construction work. Of this sum $904,000 is to be used for unification of service in Indianapolis.

U. S. Courts Upholds Phone Co. in Rate Case.

Dallas, Tex.—The U. S. Court of Appeals has upheld the Dallas Telephone Company in the suit brought by the city of Dallas against the company in which the city attempted to halt a rate increase.

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